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Huge crevasse in which pressure transforms the snow into ice, giving birth to a glacier

The Formation of Glacial Rivers

By Jas. G. McCurdy

THE formation of some rivers is a slow process. They issue forth as mere rivulets from springs or ponds and must receive numerous additions before they reach a size that entitles them to be termed rivers.

Others, such as the St. Lawrence, having their source in some vast lake, pass through no intermediate state but proceed at once upon their course to the sea. Still others burst forth with a rush and roar from the heart of glaciers, and after hurrying through rocky canyons, distribute the melted snow and ice from the flanks of the mountains to the thirsty lowlands.

The majority of the rivers of the Pacific Northwest are of glacial origin. The gigantic peaks of the Cascade, Coast and Olympic Ranges act as great natural refrigerators, holding within their icy embrace all the moisture that falls upon their slopes. Thus the precipitation which would otherwise be quickly dissipated in disastrous floods and freshets, is conserved and allowed to escape slowly through the medium of the glaciers and the glacial streams. No less than a score of ice-fed torrents have their origin in the great glacial system of Mount Rainier alone.

A glacier is not a stationary blanket of snow, clinging inert to the mountain slopes. It is a slow-moving, stream-like body of ice, descending the steep sides of the mountain by reason of its own weight.

Up in the region of the eternal snowfields the glacier begins its career. Here the snow piles up against the rock-walls until it attains sufficient depth and weight to acquire movement. As the mass slowly moves away from the rock, huge crevasses known as "bergschrunds" are formed.

Viewed from above, nothing is to be seen in these great gashes but clean snow, piled layer upon layer. For several thousands of feet the snow retains its granular consistency. Then, as tributary fields add to its volume, and the pressure is increased as the glacier plows its way through narrow confines, overriding every obstacle in its path, the snow is gradually transformed into ice of an intense indigo hue.

It has now become a veritable frozen river, flowing between parallel banks of rock, of an average width of half a mile. Its surface possesses the somber tint of old ice, relieved by patches of snow in the yawning fissures that run athwart the glacier and divide its surface into irregularly formed sections.

Gradually the glacier becomes covered with débris, consisting of rock-fragments, dirt and rock-flour, so that the real color of the frozen river is obscured. Starting from a height of about 10,000 feet above sea-level, the glacial streams maintain their solidarity until they have descended to about 4,000 feet. They vary in length from four to six miles and their average movement is 16 inches per day.

Over the roughened surface of the glacier trickle countless rills formed by the melting of the snow and ice. These tiny rivulets, by uniting, form swift streams that go coursing over the glacier, to be later engulfed by the deeper crevasses. With musical tinklings and roarings they rush into the interior of the ice-mass and finally find their way down to its utmost depths.

At the "snout" or lower end, where the glacier rears its huge wall of dull, chocolate-colored ice several hundred feet in height, the accumulated waters burst forth from icy caverns, as full-fledged rivers. They leave the glaciers heavily impregnated with powdered scoria and rock-flour. These minute particles remain long in suspension and impart to the water a characteristic milky hue. This color the rivers retain for many miles and as they flow through the lowlands upon their journey to the sea, they thus proclaim their glacial origin.

Glacial rivers, being nourished by melting ice, act in a manner contrary to ordinary streams. In the winter and spring they are at their lowest stages, while during the summer and autumn they attain their greatest size. Thus they furnish an abundant supply when it is most needed.

Moreover, as their flow depends upon the amount of ice melted within a given period, it follows that when the sun has reached its zenith, they swell to the greatest volume. During the progress of a warm summer forenoon, one may watch them grow hourly in size and violence, until at noonday they become raging torrents that sweep cobblestones and boulders before them.

Towards evening and in the early morning hours, the rivers diminish to mere brooks. Those desiring to ford such streams, either on foot or horseback, rarely do so during the heat of the day, as broken bones might easily result from such an indiscretion.

Many of the cities of the Northwest derive their water supply from rivers which ultimately find their sources in glaciers. Originating in the virgin snowfields, these streams provide water that is of icy coolness and remarkable purity.

As the waters released from their glacial imprisonment go tearing down through deeply-cut canyons, they represent an enormous amount of energy, much of which is still running to waste. A number of these rivers, however, have been harnessed and thus, through the agency of the glacier and the glacial streams, the snow, falling upon the elevated slopes of the mountains, is converted into energy that lights cities, propels trolley-cars and drives massive machinery.

Bergschrunds at head of a glacier in the Olympic Mountains—the very beginning of the glacier

Where the Nisqualli River springs full fledged from the glacier near Mt. Rainier

New Refractory of Great Potential Value in Steel Making

A NEW refractory material, zirconia, has recently come to light, which is likely to play an important roll in steel metallurgy. The two principal refractories now used are either basic or acid in nature; the new material is neither, but is regarded as neutral. It is acted upon by neither lime, magnesia nor sand, and it is even claimed that any process, either acid or basic, can be carried out in a furnace lined with it.

Zirconia as a refractory and as an alloy in steel was discussed recently at a conference at Leeds, England, between the manufacturers of fireclay goods and others interested in the use of refractory materials. It was stated that in Germany patents had been taken out for the use of zirconia in a variety of ways. A zirconia-lined hearth of an open-hearth furnace in a steelworks in Germany, after four months' continuous operation at a high temperature, was still in good condition, and capable of service at least four months longer before renewal would be necessary. Calculations based on some tests showed in actual maintenance cost a saving of over fifty per cent in favor of zirconia lining as compared with the refractory lining ordinarily used. In these calculations no allowance was made for increased production and higher efficiency.

Another interesting application of zirconia was in the manufacture of ferro-zirconium, which had been successfully employed in Germany for producing zirconium steel, a particularly hard grade, for armor plates, armor-piercing projectiles, and bullet-proof steel. Before the war there was practically a German monopoly of the raw zirconia ore, which was mainly dealt with under German patents. This is now available for this and other countries, provided the experts could find a means for transferring it.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Closing the North Sea

IN the summer of 1914 a proposal to net the North Sea on the scale outlined on another page, would have been called visionary and preposterous. In the summer of 1917, our units of measurement, social, ecouomic and military, have become so greatly enlarged that even this stupendous proposition if carried out, would be reckoned as a commonplace of this Brobdingnagian War.

The problem would be not so much the construction of such a bomb-curtain as the holding of it permanently in place. The British found it difficult to hold such nets in place in the stormy waters of the channel. In the present case, the disturbing elements would be the force of the seas at the surface and the steady pressure of the tidal currents on the whole area of the net. The former conditions could be met by making the buoyant mines carry most of the weight of the net, so that the buoys along its surface would be of moderate size. By means of the mooring cables, the net could be drawn down to float with its top edge some 20 feet below the surface and free from the wash of heavy seas. The problem would then be one of determining the thrust of the tidal currents, moving at a known velocity, and proportioning the cables and anchorages to resist it—a simple problem, as we have stated elsewhere, of engineering and seamanship.

A profession which has bridged the Firth of Forth, tunneled the Alps, cut a Panama Canal, and sent a 26-knot "Mauretania" across the Atlantic, is not to be beaten surely by a feat of engineering which will bring to a quick and victorious ending the greatest war of all the ages.

The Short-Lived Destruction of War

WITH hundreds of wrecked villages and thousands of mutilated fruit trees marking the thousand odd square miles of French territory abandoned by the Germans during the earlier months of the current year, it was a question of universal interest as to how long it would take the people of France to reclaim the devastated land—to make it even habitable. Speculation ran from a few years to a generation or more; but in no case was it expected that the redeemed provinces would be reclaimed within the life of the present war.

Truly remarkable, then, is the announcement recently made by French officials to the effect that work is progressing rapidly in the devastated districts, and that already there is promise of abundant crops in the restored provinces. It appears that the Germans, needful of every bit of food they could possibly raise in any of their occupied lands, planted crops in these provinces fully convinced that they would reap the harvest. And when, to their surprise, they were driven out, or at least decided to execute one of their inimitable "strategic retreats," they were unable to destroy their plantings. It so happens that France is an agricultural country, and her army numbers many workers of the soil; so, when the French army recovered the provinces the soldiers on furlough offered to work the erstwhile German farms. Implements have been rushed from the interior to the newly acquired regions, and work is proceeding satisfactorily on the military farms. Tens of thousands of acres bear signs indicating that they are "Cultivated by the army."

The fruit trees which the German invaders ruthlessly slashed and cut down presented a more serious problem. Yet when the French tree surgeons came upon the scene they soon found means of salvaging the grand old fruit trees which were the pride of the former French inhabitants. Correspondents tell us that thousands of these fruit trees are to be seen today in full bloom, with their trunks tied up with bandages in much the same way as a human arm undergoing medical care. Trees cut down have been raised, straightened and the trunk properly reinforced with stout splints, with the result that many of them have been saved.

Roads, which were full of gaping holes caused by exploded mines, bridges and other public works have been leveled and replaced. Indeed, all that still remains to remind the French and their British allies that these provinces were converted into a desert by orders of none else than Von Hindenburg, are the thousands of wrecked homes, churches, town halls and schools. And these too, when the time comes to rehabitate the land—when the invader is pushed still farther back so that his long-range guns and occasional aerial raids can no longer threaten the civilians—will be speedily replaced by others.

How the German Line Can Be Broken

RECENTLY we asked a high ranking military man connected with the Franco-British visiting commission if there was any hope of breaking the German line and forcing a retreat along the whole front. "Certainly there is." "But how?" we asked; and we commend his quick reply to the immediate attention and action of Congress. "If the United States would place at our disposal 5,000 aeroplanes, manned by skilled aviators, we could break through by a surprise attack in great force, and roll back the whole line. The disaster would be so widespread that peace would follow within a few weeks."

He explained that a curve showing the strength with which the Western line is held would run approximately level with a big bulge *on each side* where the German and the Allied forces are fighting at Messines, Arras, Craonne, and so on. "Under existing conditions," he said, "we no sooner move even a single division with its artillery to a certain selected position than the Germans counter with a similar concentration. But if our aeroplane strength were suddenly doubled, we could hold the aerial forces of Germany so far back of the front that it would be possible to concentrate an army of 500,000 men at a selected point, without the Germans having the slightest inkling of what was going on. With such a local preponderance, our troops could break through in force, and before the enemy knew what was going on we would be astride his communications. To save his armies from envelopment and destruction he would have to make a retreat which in any case would be disastrous, and might be absolutely fatal."

Nothing could be more true: time and again this war has brought home to us the fact that the control of the air is an essential to victory in the modern battle. At Verdun, on the Somme, at Arras, on the Craonne Plateau and at Vimy Ridge, and again at Messines, it was the airmen of the Entente forces, whose preponderance, skill and daring insured the victory of the attackers. Still, the German commanders were fully aware of the impending attacks and were able to concentrate the necessary troops on the given sectors at least to stave off a disastrous break in their lines, even though they suffered heavy defeat. The mere fact that the Entente airmen were not in sufficient force utterly to prevent the Germans from taking the air gave the latter an opportunity, slight as it may have been, to execute reconnaissance flights for the most part back of the German lines.

It has been pointed out before in the columns of this journal that the control of the air is only a relative term; and even if the Entente airmen have enjoyed the control of the air from time to time it has never been in such a degree as to "blind" the German forces altogether. Always has it been possible for the Teuton fliers to carry out reconnaissance flights, even if only behind their own lines and protected by their own anti-aircraft batteries. So every attack of the Allied armies has been prepared with the more or less complete knowledge of the German commanders, and with every opportunity for the latter to take proper counter measures.

It is not necessary to fall back on imagination for a picture of what 5,000 American aviators would mean in the war's decisive battle; for, on a small scale, the British army enjoyed practical control of the air at the recent battle of Messines. The intrepid airmen of the Royal Flying Corps, we read, did not stop at their usual tasks of reconnaissance, artillery spotting and combatting hostile machines; they carried on systematic raids far behind the German lines, dropped bombs on railroads with demoralizing effect, attacked general-staff automobiles with deadly machine-gun fire, attacked infantry on the march and in the trenches, dropped bombs on German airdromes, and in every possible way inflicted heavy losses on an enemy already fully occupied with land forces employing every machinery known to the modern soldier. So, basing our judgment on what the British airmen accomplished at Messines, it is not difficult to speculate as to the results of a battle in which ten, twenty or thirty times as many aeroplanes would take a part.

Not so much is it troops that our Allies require at present as it is aeroplanes and airmen; for given absolute control of the air, a decisive defeat could be inflicted right now on the German forces by the Entente troops. With his artillery obliged to shoot at unseen, elusive targets; with his every move known instantly to the opposing generals; with his batteries, machine-gun positions, supply stations, ammunition dumps and other military establishments subjected to a hurricane of accurate, devastating fire; with his men in constant terror of aeroplanes dropping out of the skies and flying less than 100 feet above the earth, pouring streams of accurate machine-gun fire into their ranks; with relieving troops attacked with machine-gun fire by aviators before they even reached the trenches—indeed, just as they were leaving the troop trains; with his communications, both rail and road, utterly disorganized by continuous bombing and bursts of machine-gun fire and accurate shelling; and with his utter lack of knowledge of what the enemy was preparing for him back of his own lines, the German commander on any given sector would be in a perilous, hopeless position. Surely he would be unable to withstand the onslaught of a half million fresh infantry, of whose presence he had no previous knowledge and therefore no corresponding forces of defenders.

All this can be accomplished by 5,000 American airmen. We have the manufacturing facilities ready for the undertaking, and we have the invaluable fund of knowledge of the greatest aeronautical constructors in the Allied countries at our disposal, ensuring an American product in the future that will be the equal of any the world over. We have the facilities for training the men and we have sufficient volunteers for aviation service to prepare an army of flyers several times that required.

Are we going to miss this one opportunity of winning a speedy victory? That is the question which must be answered by Congress in the immediate future.

Miraflores Lake and the Climbing Salt Water

IN connection with the interesting account, in our issue dated June 2d, of the manner in which the salt water from the sea climbs the flight of locks and makes its way into Miraflores Lake, it is of interest to inquire just how far this process can go. Emphasis should first of all be placed upon the fact that the phenomenon is strictly a physical one. Chemical diffusion, of course, is constantly taking place between the various parts of a single lock chamber and, when two chambers are thrown into one during the process of lockage, between these two; but while the tendency of such diffusion is in the direction of establishment of uniform density, it proceeds so very slowly that, by the side of the much more rapid density currents whose existence was brought out in the article in question, it is fairly negligible.

The progressive rise of a certain amount of sea water to Miraflores Lake and in a lesser amount to Gatun Lake began with the first ship to pass the canal and will continue indefinitely with the operation of the locks under traffic. This rise of sea water to the lakes takes place also when ships are locked downward or in the opposite direction to that under which the test was made. During the first seventeen months of canal operations the salinity of Miraflores Lake rose in chlorine content from six parts per million (normal fresh water) to an average surface content of 700 parts per million and an average bottom content of 1,300 parts per million. This means that the water of the lake had become roughly 5 per cent as salt as sea water.

The fresh water lakes, however, will never become as saline as sea water for two principal reasons: first, a certain amount of the denser water reaching the lake is drawn back and flows to the sea during lockage operations and second, the annual run-off from the water shed tributary to the canal constantly adds enormous quantities of fresh water to the lakes. The ultimate salinity of the lakes depends upon the number of ships passing the locks yearly; upon the annual precipitation and run-off of the water shed; upon the quantity and mean chlorine content of the water admitted to the lake and replaced by lake water for each lockage; and upon the quantity and chlorine content of the water in the lake originally.

Obviously, these are all conditions of such wide range of variation that it is impossible to formulate any mathematical hypothesis from which to derive any idea as to the ultimate lake salinity. It can, however, be shown mathematically that for any particular up-lockage a certain equivalent volume of sea water will reach the lake. This must be based however, on a given density for the lake water at the entrance to the filling culvert intakes; and the density and amount of water in both chambers immediately prior to starting the vessel into the lower lock; and it must be further based on the assumption of complete mixing taking place during filling, but without allowance for chemical diffusion, which during a period of one lockage is insignificant in its effect. Taking a specific case and given a chlorine content of 100 parts per million in the lake, it can be shown that 1,200,000 cubic feet of sea water will rise to and flow into the lake with the passage of one vessel from sea level to lake level. This means that approximately 1,000 tons of salt and other solid matter climbs the stair flight or lock under the assumptions given.

Aeronautical

Looping-the-loop in a Seaplane was done for the first time in the United States recently by Captain Francis T. Evans, of the United States Marine Corps, at Pensacola. The heavy pontoons of the seaplane, with their great head resistance, have in the past prevented looping in seaplanes. Captain Evans turned two loops before he descended.

A Huge British Aeroplane in a recent test carried a pilot and twenty passengers to a height of 7,000 feet. This machine, it is understood, is to be equipped with six machine guns and 1,500 pounds of bombs—a veritable dreadnought of the air. It is typical of the big machines which the British and French are now building, ostensibly for the purpose of carrying on raids deep into German territory as an answer to the Zeppelin depredations.

Hot Meals in the Air.—After spending several hours on patrol duty with the end not yet in sight, the airman of today would often give much to partake of hot food served to him while "on the wing." And since the only practical way by which the passengers of an aeroplane can have a hot drink or hot food is through the use of a vacuum bottle or jar, the idea has been suggested that the manufacturers of air craft would do well to build into their machines a number of pockets or wall cases for vacuum bottles, so that the latter, filled with preheated food, could be carried in safety. The suggestion is a good one.

A Machine Gun which Fires through a Hollow Propeller Shaft is characteristic of the latest French fighting aeroplanes. Instead of firing through the propeller, as is usually the practice, or firing above the sweep of the propeller, the latest French aeroplanes are equipped with a Lewis aeroplane gun rigidly mounted between the cylinders of a V-type 180-horse-power Hispano-Suiza motor, which fires through a geared-down hollow propeller shaft. To those familiar with the drawbacks of firing through the propeller or above it, the present method is at once appreciated, because, after all, it is the simplest and the best solution of the problem.

Fokker's Views of the Future of Aviation were recently published in the *Vossische Zeitung* in the form of an interview. This constructor and inventor of the famous fighting machine which bears his name said, in part: "Passenger traffic on flying machines will assume great importance after the war. Flying machines will have preference because they are the speediest means of traveling great distances. It is my belief that they will become the most successful rivals of American liners, being able to fly across the ocean within a day and a half or two days. Immediately after the war the first flight to America will be attempted. Five years after the war the service will have reached such a state of perfection that it will seem the most natural thing in the world."

What is to Become of Aeroplane and Pilot after the War?—With thousands of pilots and thousands of aeroplanes in military service today, Great Britain has already begun to look forward to the advent of peace, and is asking the question which heads this note. Announcement was made in the House of Commons recently by Major John L. Baird, representative in the House of the Aerial Advisory Board, that the government had decided to appoint a committee, under the chairmanship of Lord Northcliffe, to investigate civil aerial transport after the war. Thus it would be possible to employ a large number of skilled pilots and the aeroplanes now in the hands of the British army and navy and those in the course of construction. This is a timely question indeed, and one which will have to be solved in the reconstruction period following the close of the war.

Big Battleplanes to Replace Soldiers.—"One hundred battleplanes could carry 3-inch guns, and the muzzle energy of one hundred 3-inch guns is equal to the energy and destructive power of 60,000 soldiers," stated Rear Admiral Bradley A. Fiske recently in a suggestion addressed to Alan R. Hawley, chairman of the Aero Club of America's Central Committee on Aeronautics. "The battleplane," continued Rear Admiral Fiske, "combines the power and mobility which is needed for military operations in a higher degree than any other weapon used in army warfare. The quickest way to prepare the defense of the United States against invasion is to develop the large and powerful battleplane. The unit in all armies is the soldier and his musket. We seem tied down to that slow and feeble little unit. But are we really? Is there no device by means of which large units of power can be carried and which is not subject to the limitations of speed and size that restrict a land battleship to small dimensions? Yes. That device is now being used in Europe, after having been designed and manufactured in the United States. It is the battleplane. Such a device recently carried twenty-seven passengers. And another, an air cruiser, carried 3,500 pounds of crew and equipment."

Astronomy

The New Draper Catalogue.—According to the last report of Harvard College Observatory, the publication of this great catalogue of stellar spectra was to begin early this year. The first four hours of right ascension will form Volume 91 of the observatory's *Annals*. During the past year 8,143 additional spectra have been classified, to include moderately bright stars omitted from the original classification, since photographs of some parts of the sky are better than others.

Intensely Red Stars.—In recent photographic work at Harvard Observatory two stars have been found, one of them being the variable S Cephei, which were so red that they were photographed with difficulty. The difference between their brightness when photographed with yellow and blue light amounts to five magnitudes, or three times that of ordinary red stars. By placing an objective prism over the 24-inch reflector, and using plates stained with pinacyanol, the spectra of these and other red stars have been photographed.

A Guide to Marching by the Stars.—The present war has called forth several books designed to aid soldiers in keeping their bearings in night marches by means of the stars. The latest manual of this kind is by an Englishwoman, Mrs. H. Periam Hawkins, and is called "Guiding Stars." The book contains a revolving map, or small planisphere, which can be carried in the pocket. This map is provided with a double thread, the loop of which is hitched round the pole. The two threads are knotted at a point corresponding to the zenith for places north of latitude 50 degrees, and by certain simple adjustments of the ends of the strings and of the planisphere for date and hour the soldier is virtually enabled to lay out his course among the stars.

Prof. Pickering's Work in Jamaica.—Recent work of Prof. W. H. Pickering at the Harvard Observatory, Mandeville, Jamaica, has included a special study of Mars, from which some novel conclusions have been drawn. It is believed that the dark areas on the planet are changing their positions annually back and forth by a few hundred miles, sometimes carrying the so-called canals with them. These areas also change in color, from green to brown. Temporary blue areas have been detected near the polar cap. Color determinations have been made with a tungsten lamp, shining through blue glass. The breadth of several canals has been measured, and ranges from 30 to 110 miles. Prof. Pickering attributes the apparent duplication of canals to the rapid passage of waves of irregular density in our own atmosphere.

Solar Observations in Kashmir.—Dr. Evershed, director of Kodaikanal Observatory, India, has continued his investigations of climatic conditions in the high valley of Kashmir with respect to their suitability for solar observations. He spent several months at Srinagar (the capital of Kashmir), last year, where he obtained 725 spectroheliograms on 233 days. The general result of all these investigations, some of which have previously been mentioned in the SCIENTIFIC AMERICAN, is that Kashmir affords remarkably fine conditions for solar observation during the summer months, while the winter months are not especially favorable as to either definition or clouds. The steadiness of the air appears to be due in part to the shelter from winds afforded by the surrounding mountains, and in part to the fact that the very large areas of wet cultivation (paddy fields), greatly reduce the heating effect of the sun on the soil. The subject of suitable climatic conditions for astronomical observatories, and especially solar observatories, is one to which an increasing amount of attention is being paid. The astrophysical observatory of the Smithsonian Institution is now on the hunt for a good location in South America.

Sunspots and Prominences.—It has been generally assumed that solar prominences necessarily occur in close connection with sunspots and flocculi. Observers are, however, frequently disappointed in following a group of spots or flocculi to the limb of the sun and finding either no eruption at all or else merely a few series of small jets, where prominences of considerable size and interest had been expected. These contradictory facts have led Mr. O. J. Lee to examine the H. calcium plates taken at Yerkes Observatory with the Rumford spectrograph during the last 13 years, in order to determine the total number of prominences and the number of prominences probably connected with spots, flocculi and filaments. The examination led to the surprising result that the connection between prominences and spots or flocculi is decidedly infrequent. Only 236 out of 4,068 prominences, or 5.8 per cent, occurred in the immediate vicinity of spots, and only 324, or 8.0 per cent, occurred with flocculi in which no spot was visible during the day of observation. Of the 78 filaments which were observed near the solar limb, 63, or 81 per cent, showed connection with prominences. A large number of great eruptive prominences occur either in unmarked regions of the solar surface or where the surface seems roughened.

Electricity

Powerful Radio Station for Philadelphia.—It is officially announced that the preliminary construction on a wireless station has been begun at the Philadelphia Navy Yard. This station, it is understood, will be one of the most powerful in the world, and will have a sending radius of something like three-quarters the distance around the globe.

An Electrically-operated Machine Gun.—According to reports an electrically-operated machine gun has been invented in Switzerland. The mechanism, which is operated by electricity, is stated to be capable of firing far more projectiles in a given time than any existing machine gun, and to fire without any detonation. In the absence of definite data it may be surmised that this is some form of centrifugal gun, operated by an electric motor and similar to one tried out in this country several months ago.

Portable Electric Blower.—Consisting of a motor-driven centrifugal blower, and provided with attachment plug and cord, five feet of metal air-hose, five feet of metal gas-hose and a brazing blow-pipe, a recently introduced electric blower appears to be ideal for various sorts of work requiring a blow-torch. The blower will stand on a bench or floor, and can be carried easily to the work. Using illuminating gas, the blow-pipe will develop a temperature of about 2,300 degrees F., sufficient for all ordinary machine and repair shop work. The blower has capacity for four nozzles, so that it can be used for a single small furnace, or a number of soldering or welding flames.

Germany and the Electric Vehicle.—According to the London *Electrician*, the requisitioning of practically every petrol car for government service in Germany has given a great impetus to the increased use of the electric vehicle. Owing to the fact that lead for accumulators was practically unobtainable it is reported that a new type of accumulator has been perfected embodying the old principle of the gas battery. The gases, oxygen and hydrogen, are prepared by the decomposition of the water and compressed into the plates forming the anode and cathode. The use of amorphous platinum as a gas absorbent is said to play an important part in the construction of the battery.

Opening Letters Electrically.—A machine which opens envelopes in a continuous stream is the last word in electrical appliances for the office. Driven by a 1-20th horse-power electric motor, the envelope-opener has opened 73,000 letters a working day of eight hours. The envelopes to be opened are placed on a feed table in batches of about fifty, and they are fed through one at a time by means of two rubber rollers which pass them along past two cutting edges. The depth of the cut may be varied at will, and there is absolutely no danger of cutting the contents of the envelope, so fine is the cut. A guard eliminates all possibility of the fingers coming in contact with the knives. As the letters are opened they are thrown off to one side of the machine, into a case which is ready to receive them.

Are Iron Commutators Practicable?—On small motors the commutators are usually far too large for the current employed, according to *The Practical Engineer*. For example, a one horse-power motor of 220 volts only requires about four amperes, and if it has four sets of brushes only two amperes go through each brush. The commutator will probably be large enough to carry 20 amperes, because it will be a standard size, and it is convenient to use larger commutators and use two brushes side by side. It is curious that iron commutators have not been more used, because so long ago as 1889, F. H. Headley designed and made iron commutators, and they worked quite well. In 1895 Mr. Headley built iron commutators for dynamos up to 30 to 40 kilowatts. It was found that iron did not scour away so much as copper or phosphor bronze. There is not much saving, however, because labor represents such a large proportion of the cost of a commutator.

Influence of Stray Radiation on X-Ray Images.—In a recent issue of the *General Electric Review*, W. D. Coolidge and C. N. Moore describe some experiments on the stray radiation from Röntgen tubes. It has long been known that appreciable radiation from other parts of the tube than the focus exists, and may have an influence on the image on the fluorescent screen. In some cases overlapping occurs, impairing the sharpness. The authors have therefore investigated the effect of various devices to confine the radiation strictly to that derived from the true focusing point. The most important factor, however, appears to be the exposure. If the smallest exposure consistent with satisfactory density of the image is employed, special tubes eliminating extraneous radiation show no advantage over ordinary tubes. The explanation appears to lie in the nature of the curve of sensitiveness of the ordinary plate and the narrow range of densities employed in making radiographs of the human body.

The Submarine Problem—IV.

Closing the North Sea with a Bomb-Curtain

By J. Bernard Walker

IT would be the height of folly to conclude that the reduction in the losses of ships during the past two or three weeks indicates that the German submarine warfare is on the wane, and that the curve of losses will drop steadily from now on until the vanishing point is reached. As we go to press, indeed, the present week shows a rise of over 100 per cent above the week preceding. Of all the leading powers concerned in this tremendous problem—Great Britain, France, Italy, ourselves and Germany—the last-named power only can explain these fluctuations, and for obvious reasons Germany keeps the truth to herself.

What is the meaning of this reduction in losses? Have the Allies, ourselves included, devised some altogether new and very effective means which are sinking the U-boats faster than Germany can build them?

Is it a fact that the multiplication of hostile surface craft has so completely dominated the infested waters, that the submarines must stay below and hesitate even to show their periscopes when they hear the throbbing propellers of an approaching ship?

Is it that Germany has been working her submarine fleet and the crews which man it with such furious persistency that the submarines are badly run down and the crews are exhausted?

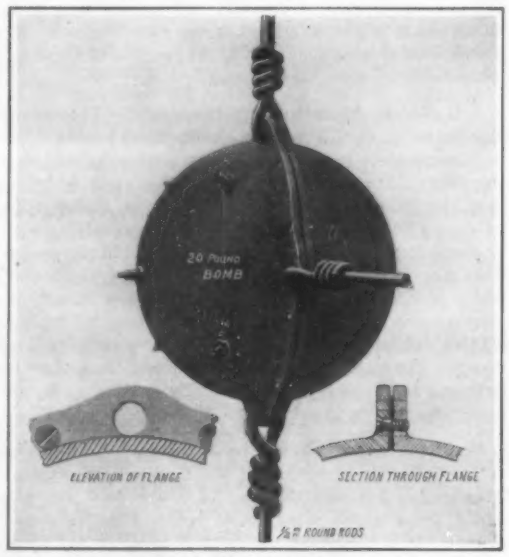
Or is it that Germany is seeking to develop a sense of false security, so that she may gain the moral effect of another sudden and portentous outburst of activity which will make the Allies hopeless of ever successfully meeting the problem? As to the truth of these surmises we are utterly in the dark.

This much, however, we do know. That every dictate of military, political and economic prudence demands that we prosecute the anti-submarine war, not with relaxed but with redoubled energy, assuming always that the worst may happen, and leaving no stone unturned to meet it.

Losses Are Still Very Serious

The goal at which the Allies should aim and short of which they should not cease their efforts, is the absolute defeat and wiping out of German submarine activity. There is a danger lest we take that terrible week when over fifty ships were lost, as our starting point, and fall into the habit of thinking that a weekly record of losses something less than that is cause for satisfaction and good reason for easing up in the submarine fight. For we must realize that the recent low-water mark of a loss of fifteen ships of over 1,600 tons is in itself a truly appalling and irreparable disaster—a rate of loss, which, if continued, must place the Allies' cause at a most serious disadvantage.

If we assume an average displacement for these ships of 3,500 tons, we reach a total loss for the week of 52,500 tons, and if this rate were continued, and the ships under



Twenty-pound bomb, built into the net and forming the intersecting connections

1,600 tons were included this would mean a loss of not less than 3,000,000 tons per annum.

Existing Methods Are Inadequate

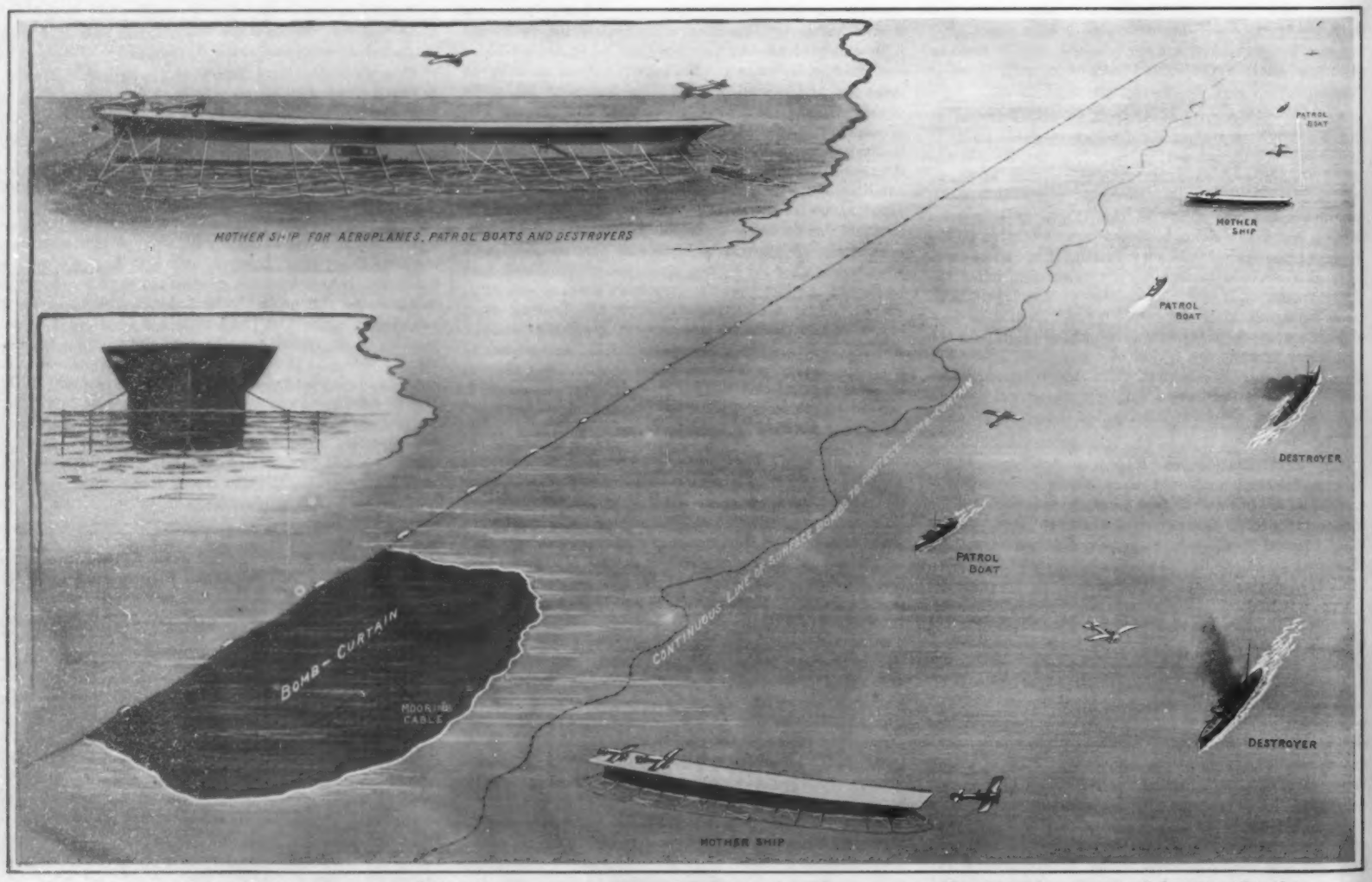
Now, if the Germans go on sinking 3,000,000 tons of shipping a year it will be because the present defensive and offensive methods against deep-sea depredations are a failure. Only a foolish optimism can lead us to any other conclusion. The Germans are getting too many ships; altogether too many; and there is something wrong either with the means and instruments employed against them or in the general principles upon which the warfare is being conducted. Now, there is nothing wrong with the instruments. They are ingenious and multi-form and are being most energetically employed on a truly enormous scale. It is our belief that in this game of submarine "swatting" ingenuity has been taxed to the limit, and we see little reason to hope that any single device, or combination of devices, or any of the tactics of submarine hunting as at present carried out on the high seas are going to prove effective in preventing this annual loss of 3,000,000 or more tons of shipping. It begins to look as though we would have to change radically our whole plan of campaign.

At the Source

It is pretty well understood that there are two broad policies by which the submarine can be fought. Either we may let the submarine fleet pass out on to the high seas, and then commence a still hunt for its individual units, or we may go to the source and shut up the U-boats within certain prescribed areas. Hitherto we have been following the former plan, and a rate of losses of 3,000,000 to 5,000,000 tons of shipping a year, proves, if it proves anything, that the plan is a failure. The fact cannot be questioned; and if this murderous piracy is to be wiped out we must adopt the opposite and obvious policy of blocking the submarine fleets at their point of exit and fighting them within their own waters. This may be done in two ways. We may institute a coast blockade by building continuous nets across the entrances to Zeebrugge, Wilhelmshaven, the Elbe and the Baltic, or we may surrender the North Sea entirely to the German submarines and shut them within it by a wall of obstruction across the English Channel at Dover and across the North Sea from Scotland to Norway.

Closing the North Sea

An estimate of the total length of netting and the total number of patrol boats necessary for closing these various submarine bases shows that a more satisfactory and more effective result can be obtained by sealing the Straits of Dover and building a huge net from the coast of Scotland to the coast of Norway. It is stated



Top of net is 20 feet below surface. One mile distant is a continuous cable with 500-pound floating mines to prevent surface ships rushing the net and shut out raiders from the Atlantic. Beyond that are the mother ships, 50 miles apart, for destroyers, motor boats and aeroplanes

Birdseye view of anti-submarine bomb-curtain 200 feet deep, closing the North Sea

that the Germans have equipped their submarines with various types of net-cutting devices, which they claim are effective and will carry the larger submarines through any net that can be built. How true this is we do not know. Rumor has it that two kinds of cutters are used, namely, revolving knives carried well beyond the nose of the submarine, and long keen knife blades extending from the bow aft, which, it is claimed, will cut through the heaviest wire work. This may be true; though we doubt it. Anyone who has tried to cut a piece of plough-steel wire knows that it requires a sharp chisel, an unyielding anvil, and no little muscular strength to do the trick, and we very much doubt if any revolving knife or razor-like edge would cut through the thick but flexible wire of a heavy net.

Be that as it may, we are strongly of the opinion that the most effective barrier would be a combination of the net and the mine, in which the net performs the function of a carrier to sustain a continuous wall of mines, so spaced that any submarine which touched the curtain would be broached and opened to the sea in one or more places.

A Curtain of Bombs

We have worked out in the accompanying drawings a system which is not only comparatively cheap to construct but (what is more important in this emergency) one which could be very rapidly put through. Considered as a feat of engineering and seamanship, it would be perfectly feasible to build and maintain a bomb-curtain to a depth of 200 feet throughout the whole stretch of water between Scotland and Norway—a distance of about 250 miles.

Since the province of this net is to act merely as a carrier for a vertical minefield, it could be built of commercial one-half inch steel rod. The mesh would be ten feet and the connection at the alternate intersections would consist of a buoyant spherical bomb, containing 20 pounds of trinitrotoluol. The bombs would be built in two hemispherical halves, with holes formed in the flanges for the attachment of the lengths of wire rods. The ends of the rods would be attached to the bomb by merely threading them through the flanged holes and twisting three or four turns of the rod snugly upon itself. Since the bombs would be spaced 20 feet apart and staggered, it is certain that at least one and probably three or four bombs would come in contact with a submarine that attempted to drive through. At the intersections, alternate with the bombs, connection would be made by a ring of the same steel rod.

Just here, we may mention that the bombs would have a sufficient positive buoyancy to carry their own load and a part of the load of the net itself, thereby making it possible to use floatation buoys of moderate size 20 feet below the surface. The net would be anchored by steel wire rope extending from each side of the net and secured to heavy mushroom anchors.

The fact that soundings off the Norwegian coast show depths of from 800 to 1,000 feet, presents no serious difficulty; it would simply necessitate the provisions of a greater length of mooring cable.

Protecting the Barrier

Inevitably, the Germans, on finding themselves utterly cut off from the Atlantic, would make desperate efforts to break through by sending a heavy force of ships to rush the net at high speed and carry it away. To prevent this, about a mile inside of the net there would be strung across the North Sea from coast to coast and parallel with the net, a continuous line of surface mines of the largest size, connected by cable and so adjusted that there would be two miles of this cable to a mile of linear distance, the cable being anchored at considerable intervals to keep it approximately in place. This would allow sufficient slack in the cable to insure that any surface ship charging at it would carry the cable with it and cause several of the bombs to swing into contact against its side.

Patrolling the Barrier

Inasmuch as the construction of a continuous wall of high explosives across the North Sea would mean the absolute defeat at a single stroke of the whole German dream of winning the war by submarine piracy, we may be certain that desperation would drive them to employ every conceivable form of attack against the barrier. Therefore, to make assurance doubly sure, it would be well to establish, a mile or so within the last-mentioned string of floating mines, a thoroughly organized system of patrol by aeroplane, destroyer and motor boat. The function of this patrol would be not only to detect, and as far as possible, prevent the approach of submarines to the net, but also to maintain the net itself, making good immediately any damage or displacement which it might sustain as a result of the enemy's attack, or the stresses of wind and weather. The basic element in this patrol would consist of half-a-dozen mother ships moored in line from coast to coast at intervals of from forty to fifty miles. These would form the supply depots from which the surface craft and aircraft would operate. The mother ships would consist of old tramp steamers (a suggestion of Mr. Chas. G. Curtis) which would be anchored securely by the head, heavy anchors and cables of great length being used, so that the ships would ride easily in the heaviest weather. For protection against torpedo attack, each ship would be surrounded by a double line of extra-heavy torpedo netting, maintained in place by unusually heavy booms and guy ropes. At the stern of each ship, sections of the net would be arranged so that they could be lowered to admit the destroyers and motor boats when they came alongside for repairs and the replenishment of fuel and supplies. In preparing these ships as starting and landing platforms for the aeroplanes, they would be swept clear of all upper works, smoke-stacks, masts, rigging, etc., and landing platforms would be built throughout their entire length, the platforms extending out twenty to thirty feet on each side so as to provide smooth runways, say 100 feet wide by some 400 feet in length.

The patrol would be in three zones—the inner one extending between the mother ships would be covered by the flotillas of motor boats; the intermediate zone, from twenty-five to thirty miles in width would be covered by the destroyers, and the outer zone, reaching one hundred miles or more into the North Sea, would be under the watchful eye at all times of the aeroplanes.

Bomb-Curtain versus Wire Netting

The advantages of such a bomb curtain over a steel-wire net of sufficient strength to stop a 2,000-ton submarine are:

I. That because of its simple construction and the speed with which the wire rods could be turned out at the mills, it could be built in far less time.

II. That whatever the size and speed of the submarine or the character of its net-cutting devices, contact with the bomb curtain would mean certain destruction, or at least disablement.

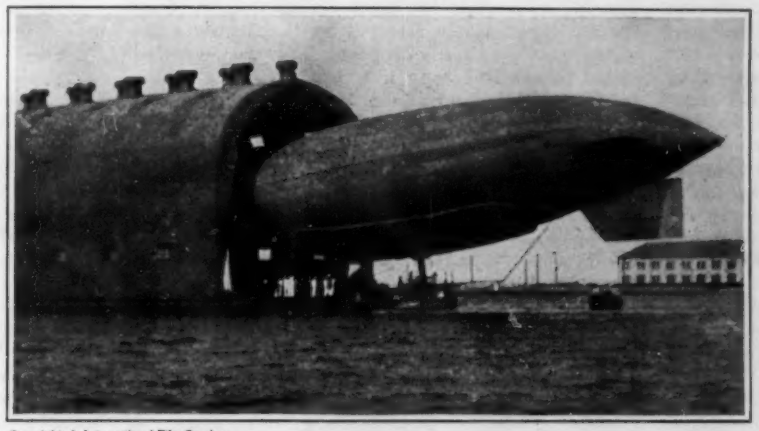
In this matter of defeating the submarine, time is the very essence of the contract, and although a curtain 200 feet deep and 250 miles in length is a colossal undertaking, it could be built for a reasonable cost and within reasonable time.

Half-inch steel rods weigh about two-thirds of a pound per foot, and they could be delivered, cut to length at an English port for about $150 per ton. Such is the capacity of our mills that the whole amount of 18,000 tons could be turned out in a couple of weeks' time. The cost of the rods, anchors and cables would be about $4,800,000. The bomb containing 20 pounds of trinitrotoluol would be sufficiently powerful to cut a hole through the interior hull of a submarine or badly wreck its outer hull, rendering it unmanageable. The bomb would be made in two halves, and with its flanges could be stamped out of three-sixteenth plate. Manufactured on a basis of quantity-production, the bombs could be produced complete with contact points and firing mechanism for about $35 apiece, which would represent a total cost for the bombs of about $45,000,000. Adding the cost of materials for the net and anchorages, $4,800,000, we arrive at a total cost for materials of the whole net of about $50,000,000, which is less than the total value of ships and cargo sunk by the submarines in a single week of the present campaign.

The firing mechanism of the bombs would have to be of special design, to prevent the whole net from being set off by sympathetic shock when one of the bombs was detonated. We understand that a firing mechanism can be produced, which will resist the sudden shock from a nearby explosion, and can be operated only by a blow or push of comparatively low velocity, such as would be applied if the firing pin were struck by a submarine moving at a rate of eight or ten knots. To render the bombs safe for handling by the seamen as they build them into the net, the firing pin would be locked by a cement which would be soluble in water, thereby insuring that the bombs would become alive only after they had been in water for ten or fifteen minutes.

If the approaches to the North Sea were protected by successive lines of aeroplanes, scouts, destroyers and patrol boats, and finally by an impassable wall of bombs, it is safe to say that the Atlantic routes would be rid, once and for all, of the submarine pest, and America would be free to send over food, munitions and troops without fear of molestation.

A similar net at Gibraltar and at the Straits of Otranto (the mouth of the Adriatic), would effectively block the submarine bases of Germany's allies.



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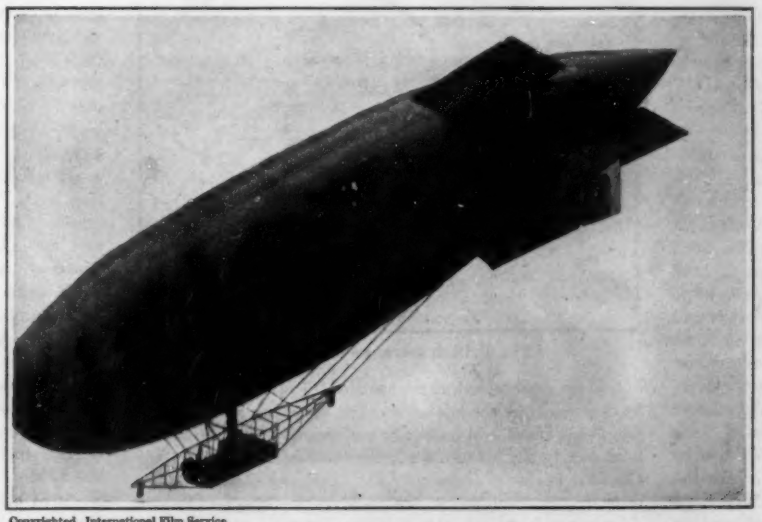
DN-1 leaving the floating hangar at the Pensacola Aviation Station, preparatory to a trial flight



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The Navy non-rigid dirigible DN-1 in flight. Note the boat-like car which permits the dirigible to alight on water

Our Navy's First Non-Rigid Dirigible

AT the aviation station at Pensacola, Fla., our Navy's first non-rigid dirigible recently undertook its test flights. Success attended these preliminary aerial voyages, and the DN-1 has been added to the aeronautical equipment of our naval forces.

Under the direction of C. F. Smyth and Hans O. Stagel, general manager and pilot, respectively, of the airship's constructors, the DN-1 underwent the first trial flight. After leaving the floating hangar at the aviation station the dirigible ascended to a height of 1,000 feet, crossed the bay, sailed around Santa Rosa Island, and then circled the city of Pensacola. During the flight the DN-1 made two landings on the water, for which purpose the underbody or car is especially designed.

The balloonets only were used in making the ascents and descents, and 22 gallons of gasoline were consumed to maintain a cruising speed of 30-35 miles an hour during the two-hour flight. In fact, the performance of the dirigible exceeded even the expectations of the constructors.

Two dirigibles of the same type are now under construction and will probably be ready for the Government some time in July.

Broken Cast-Iron Pulley Replaced by One of Concrete

ONE of the pair of cast-iron pulleys carrying the main elevator in a large eastern stone crushing plant recently had practically the entire rim broken out. The pulley was 54 inches in diameter with a 20-inch face, and a spare unit was not available. To avoid shutting down the plant for some time while a new pulley was procured it was decided to repair the damage by pouring the pulley full of concrete. A form was built in place around the remains of the old pulley, using perforated metal faced with building paper for the rim and wood for the sides. The belt was not removed while the entire interior of the form was poured full of 1:2:3 concrete. The work of pouring was completed at 6 P. M. on Saturday and the pulley was put in service at 11 A. M. the following Monday. The work was accomplished satisfactorily and the belt runs directly on the concrete.

Strategic Moves of the War—June 14th, 1917

By Our Military Expert

JUST as the last review was finished, the British began on June 7th one of the most important moves of the war—a drive against the German salient jutting into the British lines at Wytschaete, three miles south of Ypres. This salient had long been a thorn in the side of the British advance and its capture has added a great deal to the advantage of the British armies in that portion of the front. The base of the salient was about three miles across and at its southern end was the village of Messines; this was carried early in the fight and later, by pressing along other parts of the lines, the Germans were driven back all the way from the woods around Ploegstreet north of Armentières to and beyond Hill No. 60 southeast of Ypres. After a colossal bombardment of seven days, said to be the heaviest of the war, the attack was preceded by the greatest artificial explosion the world has probably ever known. The scene of this explosion was Messines Ridge and north to Hill 60 which went up in dust and dirt with other strong points. The mines had been under preparation for two years or more and a million pounds of explosives were said to have been employed in changing the hills, as one writer states, "geographically and strategically."

Messines Ridge is a low promontory extending along a good part of the fighting ground of the day; it is an insignificant bit of ground rising not more than 200 feet above sea level; but the country around Messines is so low and flat that the Ridge had a value for observation purposes that could not be reckoned. It dominated the British lines in the vicinity and had been held by the Germans since 1914. Its capture became a necessity as it was the acknowledged key position to the northern part of the British front. By the concentration of artillery fire the advancing troops were sheltered and protected; the manner of doing so is described as a result of the experience in this war alone. First a barrage of smoke shell interposed an impenetrable barrier or curtain to confuse the enemy's gunners and marksmen. Then in advance of the troops a screen of shell was thrown that entirely prevented any movement of resistance. The German batteries in action were thrown into confusion by a hurricane of gas shell and any attempt to bring up reserve or help of any kind was stopped by a long distance range of high explosive shell on the German lines of communication. General Pétain has been quoted as saying that success in the present modern methods of warfare is determined by "guns and then by more guns" and certainly it can be said that all the arts and deviltries of war are now due to modern artillery.

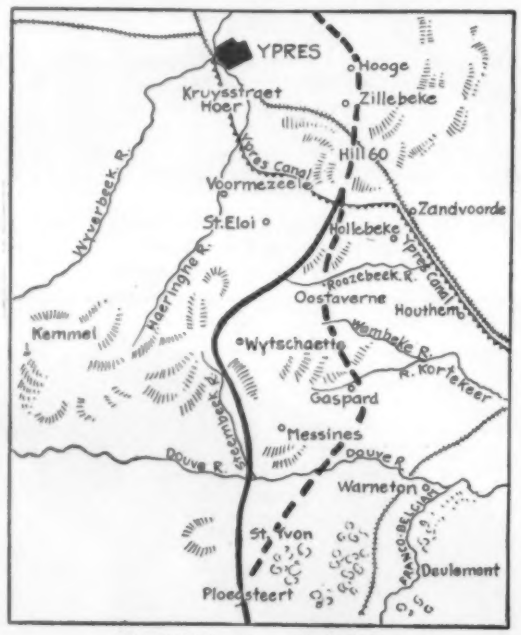
As a result of all this and the most complete preparations the Wytschaete salient has been wiped out and the German forces that held it have not only been driven out but are apparently utterly demoralized by the furious onslaughts of the British armies. The battle has been a measure of the ability of the German troops to hold the British under as favorable conditions as they can hope for, since they possessed not only the advantage of ground and preparation but also the knowledge that such an attack was coming. It is also a direct threat against the great industrial cities of northern France—Lille, Tourcoing and Roubaix. By wiping out the Wytschaete salient the British front is gradually encircling Lille both from the north and south and is now only five or six miles away from that city in some places. By the successes east of Arras a dangerous menace to Lille from the south was started and now a similar enveloping move from the north has been begun. It is another case of the pinching methods that are being carried out around Lens.

The long and carefully prepared blow just delivered at Messines and vicinity shows the deliberate plans of the Allies this year. They are to be the hammering methods followed so often in war and are intended to give the Germans no let-up from the nerve strain of constant attack at different points. Even when these attacks have no great strategical results, they have on one's adversaries mental effects that are extremely disheartening. The British and French are learning to break through German lines at a minimum loss of life and material. It is the constant repetition of these results that destroys the morale of any army; for no troops can withstand for any length of time such punishment as the Germans have received first at Arras and now near Ypres. The fighting spirit and courage of every army must be destroyed by such reverses when often repeated and this now seems to be the fate of the German army on the West front.

Undoubtedly, with the advantages now gained on the north, the British will once more make the Arras sector the scene of severe fighting because it is here that only a relatively slight barrier on the Drocourt-Quéant line stands between them and Douai. To break this line will be to shatter the German defense system in this part of northern France. Reports received at this time indicate that fighting is extending even into the sector between Cambrai and St. Quentin, where there has been a cessation of fighting since the Hindenburg retreat. Along the Scarpe the British forces advanced about a mile beyond Gavrelle and carried a number of German trenches on Greenland Hill southeast of that village. This hill is the only strong point still held by the Germans on the lines south of Oppy and on the Oppy support line. The efforts of the British here and around Lens indicate that their commander intends to clear out this part of the line before again beginning a general offensive along this part of his front.

On the Italian front along the Carso plateau, it is difficult to determine the happenings of the last few days, but it is evident the Italians suffered a reverse in the vicinity of Jamiano. This, if true, puts an end for a time to the forward movement so brilliantly planned and so well executed. The Austrian counter-attack came first where it might be expected—that is, in and around the works near Mount Hermada, supporting the left flank of their defensive line and barring the appr. aches to Trieste. As a whole, the threat against their left flank has not been entirely removed by the Austrians, no matter what has already happened, for every advantage gained by the Italians in this vicinity forms a double threat against Laibach as well as Trieste. And should Laibach fall at any time, the way to Vienna would be open for an advance.

Unless conditions are fully reëstablished much of the good work carried out on the Austrian left flank has been undone and the lines must be reëstablished. There is



The British advance in Belgium

but little doubt that the unsettled conditions in Russia have permitted the withdrawal of large bodies of troops from that front and have allowed Austria to concentrate here nearly her whole available force in and around the Gorizia fields of action. The Italians started their offensive operations at the end of the English-French drive and it is said the respite there gained allowed Germany to aid also with her troops. Now that the British have again begun a drive around Ypres, these troops will have to be taken back and Austria will again be weakened in the great battles around the Carso. The Italians continue to claim to have gained formidable Austrian defences on the Isonzo River and on the Carso plateau, thus forcing the Austrian commander to make a counter-offensive; this, though strongly pushed and fiercely contested, failed of its objects. These objects were two—first to gain ground on the actual battle front; and second, to save the Austrian government from the financial and political disasters with which it is threatened from internal conditions.

Evidently operations have also begun on the Trentino front as strong fighting on the lines there is reported. It is only through the Trentino that an advance by Austria into Italy can be made; if there has been a serious reverse for Italy on the Julian front, perhaps it has been concluded that the time is ripe for an invasion from the north. However, the fact that the Italians themselves began the new Trentino drive, despite the aid derived by the Austrians from the troops from the Russian front, would indicate that the Austrian attacks on the Julian front have failed of their object. The Italians began their offensive by attacks in the region southeast of Trent and captured two important positions from the Austrians—one being Monte Ortigara above the Val Sugana and the other the Angello Pass that opens a comparatively level road toward the Brenta River and the town of Borgo. The latter will no doubt become one of the objectives in the offensive movements of the future in this theater of operations. All along the Asiago and Arsiero plataeu there has been heavy fighting and artillery fire despite sleet and snow storms; when it is recalled that these table lands are 7,000 feet above the sea, severe cold storms can be expected even at this season of the year. The advance just begun is along the same front where the Italians stopped the advance of the Austrians last year and threatens the center of the Austrian positions leading from the Trentino into the Sugana valley.

The new offensive has greatly encouraged the Italian people who have been much concerned over the report of reverses on the Carso front. All that has been said of a separate peace between Germany and Russia has been rudely interrupted by a resumption of the fighting on the Eastern front where the Russians have begun the struggle. Offensive movements have started all along the Eastern front, special accounts being given of fighting southwest of Pinsk in the marsh country and near Brzezany to the east of Lemberg. At last something definite seems to be coming out of the chaos that has reigned in Russia since the downfall of the Romanoffs a few months ago. What has been needed from the beginning has been strong action by those who are opposed to riot and disorder; these have had their first tests of strength, by reports from Petrograd, where regiments have been surrounded and forced to surrender their leaders to loyal troops. The present government seems to be finding itself and, with something akin to the stumbling child's first efforts, is beginning to walk.

As might be expected, the discipline of the army has shown its good effects for, wherever the real situation and questions at issue have been explained to the soldiers they have given clear proof that they had only been deceived and were sound at heart.

Unfortunately the mistakes of the revolution have permitted the massing of German troops from the Russian frontier against the French and English on the West front and against the Italians on the Carso and Trentino battle lines.

Another monarch has also ridden to a fall and a great stumbling block to the progress of the Allies on the Saloniki front has been removed by the abdication of the Greek king, Constantine, brother-in-law of the German Emperor. The Allies have here gained an important victory for they no longer have an enemy in rear of their lines to hamper them in any extended advance in Macedonia. They are in a position where they can be a great menace to the Teutonic Allies' lines of communication with Turkey, even if they cannot make an effective advance to Constantinople on the east or to Belgrade and the Danube on the north. None can deny that Constantine was a man of capacity and political management for he was able to hold the greater part of the Greek nation and a good portion of the Greek army against the Allies, despite the fact that it was generally known that he had ordered the surrender of Greek troops, forts and military material to the Bulgars, that he had instigated the attack some time ago on the French troops in Athens, and had encouraged, if he had not organized, guerilla warfare in the rear of the Allies' army. His abdication has finally brought to an end an impossible military and political situation; it remains to be seen whether the Entente Allies, who have apparently gone from one blunder to another in this Greek situation, can now straighten the tangle and aline the army and the people of Greece firmly on their side in the war. If this can be done, a little political strategy, if combined with some military successes in the operations now under way on the Vardar front and to the north of Monastir, may lead to the early withdrawal of Bulgaria from the war, for it is now well recognized that the Bulgars were led by their German king, Ferdinand, to the aid of the Central Allies against their own will, interests and inclinations.

Peat "Cotton" in Wound Treatment

THE Russian engineer, M. Gubareff, remarks that there is a good field for the use of the agglomeration of fibers extracted from peat and known as peat "cotton" (or wool), for the treatment of wounds, and recent experiments made in this direction by M. Wolkmann show that this substance is excellent for absorbing the secretions from wounds. It can be put very successfully through the sterilizing process by the use of steam, and can be employed for wounds in two general ways, first in the shape of small cushion-like bags, and second as a stuffing or lining for different bandages. The only drawback in the use of this substance lies in the fact that it is very brittle on account of the short length of the fibers, and it readily falls into dust when too dry. Contrary to what has been asserted, this substance contains no pathogenic microbes, and indeed it contains matter of a tarry nature which has an antiseptic action.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Horticultural Need

To the Editor of the SCIENTIFIC AMERICAN:

I am exceedingly anxious to procure a practical machine which is simple in construction, yet reliable in its operation—suitable for capping and stemming green gooseberries on a large scale.

Diligent enquiry does not elicit the fact that such a machine is on the market.

If some alert inventor will produce such a machine, I am positive that a *very extensive* sale could in time be found for it, as it would at once place the gooseberry in active competition with the cranberry in its very general use for tarts, sauces, etc., while at the same time the diffusion of the plant has a very much more general range over the country than the cranberry can ever attain.

I am positive that there are very many horticulturists interested like myself in securing a machine at a reasonable price which will prepare the gooseberry for market. The season for the use of them will soon be at hand, and I should like to hear of their introduction on the market.

H. H. SPINDLE.

San Diego, Cal.

Moonlight Photography

To the Editor of the SCIENTIFIC AMERICAN:

The writer came across a clipping from the Winnipeg *Tribune* of August 14, 1913, reproducing an article from your paper, re fake photography, and an article in reference to moonlight views. This was of interest to the writer, and he begs to enclose copy of a moonlight scene taken August 31, 1914, at 10.30 o'clock with a full harvest moon.

Your articles stated exposures should vary from 30 minutes to two hours. I enclose a rather successful moonlight view which was taken in 2½ minutes. It may be that our harvest skies particularly are exceedingly clear. There were four or five others who took pictures of this same view, each giving different exposures, but they were all more or less of a failure.

The following year I tried a moonlight scene with the moon lower to the earth, with the result that the branches of the trees and other objects were more or less blurred as your article suggested. It is therefore obvious that to take a good moonlight scene the moon must be full and as high in the heavens as possible.

W. A. BISHOP.

Winnipeg, Canada.

Air Cushion for Ship

To the Editor of the SCIENTIFIC AMERICAN:

I would like to make a suggestion which I believe, if properly carried out, would be very useful in imparting to a ship resistance against the ramming and explosive force of sumbarine torpedoes.

At the present time when an explosion occurs against or near the submerged side of the ship, the force is not only directly communicated to its plates, using the water intervening as a solid unyielding ram, but the ship's side, having air spaces behind, will offer a path of least resistance, so that said plates must crush in over a large area.

In my estimation an effective means of cushioning the intensity of the blow would be to provide an air space of cellular structure of the proper thickness around the submerged hull. The outer plating used should be strong enough to resist the impact of the weight of the torpedo. The air space would absorb some of the explosive shock while the inner heavier plates would stop the flying fragments.

I believe if a torpedo exploded even a considerable distance away from the ship, against a solid protective barrier, it would be severely strained, because of the perfect transmitting power of the water.

While it is true that the outer hull referred to would increase the width of the ship which would detract from the speed, it would at the same time have a compensative effect in that there would be less draft because of the added buoyancy.

ALBERT F. SHORE.

New York, N. Y.

A Physiological Query

To the Editor of the SCIENTIFIC AMERICAN:

After careful study of the physiology of the nervous system it has occurred to the writer (a civil engineer pursuing psychology as an avocation) that the mysterious relation between mind and brain can be entirely explained by merely assuming that the dendrites of the cortical pyramids expand when excited.

As a simple illustration of this theory, let us analyze the case of a child learning to recognize and pronounce the letters of the alphabet:

Exposure of the child's retina to the impressions of the printed letter "A" induces an electrochemical reaction or impulse which is transmitted to the visual area of the brain and accumulates in particular fibers adjacent to the line of Baillarger. Now suppose the teacher pronounces the vowel "A;" the child instinctively repeating the sound, a neural arc is established through the cortex between the auditory nerves and the vocal organs, the dendrites of all the cells in this arc expand radially, those dendrites near the visual area come in contact with the fibers excited by the visual impression of the letter "A," the accumulated impulses discharge into the efferent nerves used in pronouncing the vowel "A," and a more or less permanent path is established for impulses induced by subsequent visual impressions of the letter "A." We now say the child has learned to recognize and pronounce the letter "A."

However, this theory has never been proved. Is there not among the readers of the SCIENTIFIC AMERICAN someone who is properly equipped to demonstrate the expansion of the cortical cells, and willing to make the necessary experiments for the benefit of humanity?

F. A. LIPPINCOTT.

Sharon, Pa.

Shallow-Draft Ships and the Submarine

To the Editor of the SCIENTIFIC AMERICAN:

Kindly give space in your periodical to one or two suggestions that are worth pondering.

A few facts to start with:

1. The Monitor class of war-craft, (originally intended for river-work) that did the off-shore fighting at Westende and Zeebrugge were fairly immune to torpedo attack on account of their shallow draft.

2. The present 80-foot motor "sub-chasers" are also fairly insusceptible for the same reason. A torpedo is "set" to take a depth of 8 or 9 feet (am I right?) and having found that to maintain that depth consistently and constantly. If it were to travel shallower it would be apt to splash out and be deflected, perhaps turn round and play boomerang.

3. For this reason the present type of freighter which is deep in the keel to prevent leeway and also because it carries quite a load, is very open to attack. If the torpedo is aimed and timed right, the freighter can hardly escape an attack made without warning.

4. Although torpedoes are quite expensive (and probably "going up" all the time like everything else) yet if one torpedo sinks one freighter a good stroke of business—from the German point of view—has been done.

5. The interned German ships are to be called in and made use of. But in time they, too, will be all sunk and destroyed. That is only a deferring. It is in no way a solution of the problem.

6. To offset rapidity of destruction—and the torpedo campaign is successful enough to be getting very dangerous—rapid shipbuilding is to be inaugurated and to allow of quicker output a standardized type of freighter is to be built.

All very well and good. But every time a ship is sunk a cargo goes to the bottom that cannot be replaced until a year goes by. The ship can be replaced more quickly but the cargo is gone. The sunken ship may even be refloated, but a short time of submersion soon ruins most cargoes.

Why lose any ships at all or any cargoes? Now this suggestion of mine may not *appear* practical from the standpoint of present marine practice. But, surely, if it gets results it is *bound* to be practical.

The absolute and final test of all ideas is "Will they work?"

Well this will.

Instead of putting all the eggs in one basket; instead of loading one fine tall ship to her plimsolls with a valuable cargo, why not load that same cargo on half a dozen or even a dozen "scow freighters" of shallow draft?

They could be built big enough and broad enough in the beam to carry a moderately-big cargo without being sunk to the 9-foot draught. They need not be built for speed; they need not even be built even for tonnage, primarily. Even though they should take twice as long to make the passage as a present freighter, even if it took six or a dozen of them to carry the load of one present freighter; yet *if they all got there*, if six of them came chunking up Clyde or Mersey, convoyed by a destroyer, arriving without the loss of a life or of a cargo, would that not be infinitely better than a big freighter not arriving at all? They would be very welcome indeed for all their slowness.

They might or might not carry a gun. They could be convoyed by a destroyer or a motor "chaser."

Even if one scow were sunk the loss would be fractional, not total, and the expense (to the Germans) of sinking the whole fleet of them would be prohibitive, conceding that torpedoes could touch them at all.

The submariner would not dare emerge to use his gun on account of the presence of the destroyer.

It is evident that the type of freighter that is best in peace time is not at all the type that is best to meet war conditions. The present torpedo is made for the express purpose of sinking such vessels of deep draught. Why build to satisfy the torpedo? Why aim at speed? Why aim at carrying-capacity? Why try to build against the pace the torpedo is setting?

Take the *reductio ad absurdum* argument. The type of floating things that is absolutely immune to torpedo attack is a raft.

Well, a raft would not carry very much. But why not try to attain at least *some* of the immunity of the raft while adding as much cargo-carrying capacity as is consistent with safety?

The torpedo is designed expressly to sink present freighters. Why not aim at an ideal boat that is different altogether from the ideal carrier in peace times? Aim at a boat of shallow draught, an inexpensive boat, a slow boat—these qualities if they cannot be bettered, but a safe boat, a boat that will get there. The desideratum is to *get there* and to *get there safely*.

Surely one of the lessons to be learned from the Monitor type of war-craft and also from the motor "chasers"—their immunity to torpedo attack—ought to be applied elsewhere, where protection from torpedo attack is the main desideratum.

Build a type of boat to carry as much as possible compatible with immunity from torpedo attack secured by shallow draft. Let there be a number of such, so that the load of one freighter of present type and deep draught is divided up among half a dozen. Do not aim at speed or tonnage. Let *safety* be the primary consideration.

ROBERT W. AULD, M.D.

Alberta, Canada.

A Labor-Saving Suggestion for the Garden Movement

To the Editor of the SCIENTIFIC AMERICAN:

Would it not be well to consider the efficiency of the method of applying the labor on the garden-raising plan?

For each individual to do all the tending of one garden spot is not the effective method. Considering that the motive impelling the majority to join this movement is a patriotic one, I would suggest that it be done on a scientific basis, taking advantage of the system of *division of labor* by clubbing a dozen or more lots in one working unit, each party working at one part of the work on the whole number of gardens, and then divide the profits proportionately to the work each man has done. This being a much more efficient working method, it would give much larger profits and would utilize the labor to much better advantage which is of very great importance this year.

Cleveland, Ohio. JOHN A. MATHES.

Protection Against Submarines

To the Editor of the SCIENTIFIC AMERICAN:

I am sorry you cannot keep us posted as to what and where our navy is—of course I know the reason and honor you for it, yet I well know the good reading you could feed us on if allowed to. I have followed your articles for and against the navy and feel that I am qualified to say my say as an informed man when arguments start. In this connection I wonder what speed some of our fastest liners would make, if any, when protected from torpedoes, as suggested by many well-meaning people.

After the liner has fined her lines down and sacrificed life-boats, for speed, then to hang chains down and put barbed wire fences around them: these and then the omnipotent "battery and magnet torpedo eradicator" from the farming districts. I suggested to one of these "inventors" that we should have a man in a rowboat go ahead of the 25-knot liner and hold a vacuum cleaner over the water to catch the torpedoes, and blessed if he did not think it was a good idea to work out. I gave him all my rights to the invention then and there.

CHARLES M. GREEN.

Bedford, Ohio.

Fishing for Subs

To the Editor of the SCIENTIFIC AMERICAN:

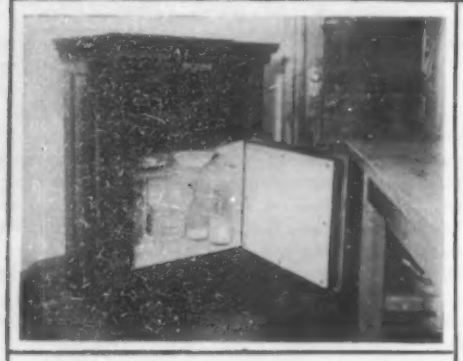
In reading of the different ways of putting the submarine out of commission, I have not seen any suggestion to catch them on a line.

Perhaps they have not the right kind of bait. I would suggest they catch a young torpedo and put fins on him so he would dive when towed behind a submarine-chaser. If he can be made to dive deep enough I would think the chances of making a catch would be good.

By using a sea-plane or instruments for detecting sound under water, it would be possible for a small fleet of submarine-chasers to tow the torpedoes across its course and get it.

E. J. POLLOCK.

Eldred, Pa.



The right way; even the consumer has his obligations of cleanliness

Dairy Preparedness

Educational Work of the Dairy Division of the Bureau of Animal Industry

By C. H. Claudy

The wrong way; milk bottle standing open under the dripping family wash

"PREPAREDNESS" is a word with many meanings —and a new definition comes in the public mind with every day that passes. But one thing has been finally settled as fundamental. That nation is not and cannot be prepared for anything which is not healthy, and which does not conserve its resources of health and life as well as those of minerals and oils, munitions and battleships, arms and armies.

It is not only true that one-half the world doesn't know how the other half lives—it is unfortunately true that one-half doesn't know what the other half does. That the United States Government is working diligently to promote pure food is known to all; that it has specialized in dairy farming work, and elaborated a campaign looking to better cows, more cows, healthier cows, better butter and cheese, will be news to many. Yet the Dairy Division of the Bureau of Animal Industry of the Department of Agriculture is doing more than its share of promoting that industrial preparedness which must be the root of all preparedness which is of fact rather than of words.

During its 21 years of existence the division has had a rapid growth. In 1895 it had four employees; today it pays 175. Within this interval one of the most complete equipments for dairy research work in existence has been provided. It is in charge of a corps of highly trained research scientists, not only in the laboratories but on farm and in factory. Facilities for investigating almost any dairy problem are at hand and in constant use.

Eleven years ago extension work was begun with both individual farms and communities; a labor in progress today in more than thirty States. Extension work is educational, but perhaps the greatest value is in the opportunity to carry to State extension forces, and through them to dairymen, not only results of the investigations and experience of the division itself, but results obtained in any State institution. Uniform practice in cow testing and bull associations and other similar branches of the industry are thus being gradually established in the various States. Investigations of many kinds are constantly in progress, all looking to one end—cheaper cost and better product.

Among the more important subjects taken up are manufacture and handling of ice cream; utilization of creamery and cheese factory by-products; disposal of creamery and cheese factory wastes; milk condensing, brooding, feeding, housing and care of dairy cattle; silage changes; studies of cost of milk production and milk handling; physiology of milk secretion, and metabolism in dairy cows.

But the spread of knowledge to those who already have plants, or cows, or who make butter, is but one feature of the work. To show how a careful investigation leading to a definite conclusion can increase per capita wealth in a given region, consider the cheese industry fostered in the South by the Dairy Division.

In some southern mountain sections, far from railroads, fertile valleys with cool climates and plenty of cold springs constitute ideal cheese-making locations. The inhabitants of many of these valleys have always raised cattle, but without being able to sell their milk. Where families are large, making labor cheap, anything which furnishes profitable employment is an economic asset.

The Dairy Division, realizing this, presented the idea and three cheaply constructed factories were erected. A description of one tells the story of all: "A factory

Showing what happens when a hair drops in the milking pail. The excrescences are bacteria

built at a cost of $500, was opened on June 5th, 1915, with 63 gallons of milk, which later increased to 195 gallons a day. During the season 104,990 pounds of milk was made into cheese which sold for two cents more a pound than was received by some of the Wisconsin factories. The $1,585.68 received by the factory for cheese was a considerable financial benefit to the section. One woman who received a check for about $12 for milk at the factory, remarked that "it don't look right to take the money. I did nothing to earn it." Properly guided, all this work means a cash industry for many people in a remote section of country. It is estimated that about 30,000 square miles of territory in the southern mountains offer opportunities for cheese-making and it requires no great imagination to measure the possibilities of dairying for this territory.

The day of the milk man who sold his milk from an open can, sometimes including his thumb in the quart measure, has passed in the average municipality. But clean milk at your door is one thing—clean milk, clean cream and thus clean butter from the farm is quite another. Not that the average dairy farmer is intentionally unclean; he often does not realize that cows which stand in an unsanitary stable cannot produce either healthy milk or paying milk, compared to the animals which inhabit modern and sanitary quarters, and are milked either by a clean-overalled milker with sterile hands, or by suction machinery. It only needs the contrast pictures to tell that story to us who consume, but it needs demonstrations to show the man who has to pay the bills that it is his duty, not only to the community but to his own pocketbook, to produce milk of the highest possible quality.

Two pieces of machinery, kept oiled and running smoothly by the Dairy Division, have served to spread the doctrine of greater profit in good milk in a marvelous fashion. These are the cow testing association and the milk and cream contests. The first cow testing association in the United States was formed in Michigan in 1905. There are now 350 such associations in active operation in thirty-three States and the Dairy Division now has fifteen men engaged in promoting the work, ten of whom are jointly supported by the extension services of the agricultural colleges of the States in which they work.

In the 350 associations 150,000 cows are tested every month. In other words, some 7,500 farmers in the country know, through cow testing association records, how much milk each of their cows produce, its real value, the feeding cost, and how much profit or loss must be charged to each cow each year. Spending $225,000 a year for this service, the farmers who benefit consider they receive excellent interest on their money. Just why can be best explained by showing results; the farmer who has a cow which loses money, loses the cow—and gets a money maker in her place! The following table shows the results of a four years' test in ten herds.

Year	Average annual milk yield per cow	Average annual butterfat yield per cow	Average annual food cost per cow	Average annual profit over food cost per cow
	POUNDS	POUNDS	DOLLARS	DOLLARS
1911	6,483	246	26.40	32.42
1912	7,649	277	52.31	30.20
1913	8,738	285	43.67	52.95
1914	8,648	312	48.12	66.02

The mechanical milker at work. No dirty hands in the milk, no dirty cow standing over the pail

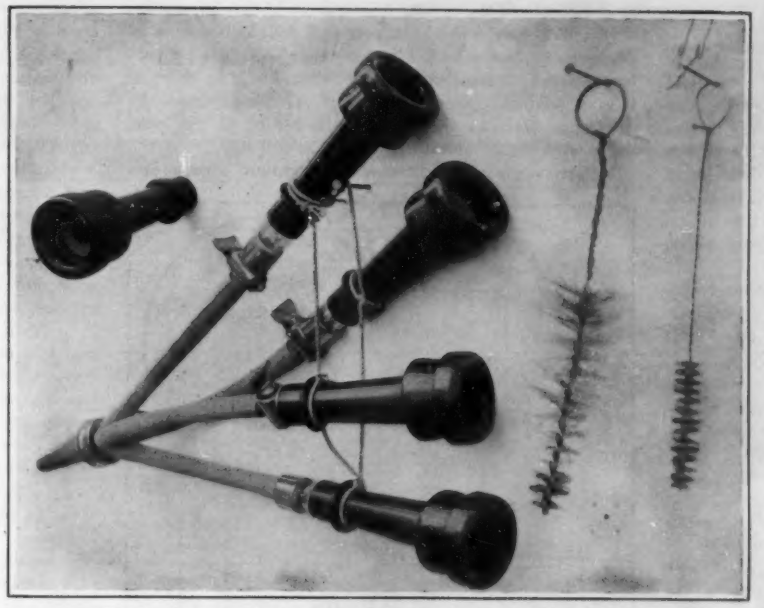
In the twentieth century dairy, the cows are clipped and cleaned by machinery

These increases are due solely and entirely to knowledge gained by dairymen of the actual, not fancied, value of their milkers. It is obvious that a more than double profit in four years' time from 100,000 cows, must be a tremendous asset.

The milk and cream contests, held in coöperation with State and municipal health authorities, were begun in 1906, and since then the Dairy Division has coöperated in 47 contests. Samples submitted are judged on a basis of bacteria, flavor, odor, visible sediment, chemical composition, and the package appearance. That the contests have been of great assistance in improving milk quality is demonstrated by the showing of any individual dairyman at his second contest. He almost invariably exhibits a second sample of higher value than his first one. During the contests consumers are taught by means of lectures to appreciate the advantages of clean milk, and of the additional cost of its production. Health officers of many cities testify their best dairymen receive the first impetus for really clean milk production through such contests.

Helping the operator of a milk plant is an integral and very important part of the labors of the Dairy Division, since health or its lack may easily spring from such plants. Beginning in 1912, systematic investigations of milk-plant economics was begun. Surveys of city milk distributing plants throughout the country have been made, including compilation of data on labor costs and efficiency of various types of machinery,

(*Concluded on page 627*)



The business end of the mechanical milker, and the brushes that keep it clean

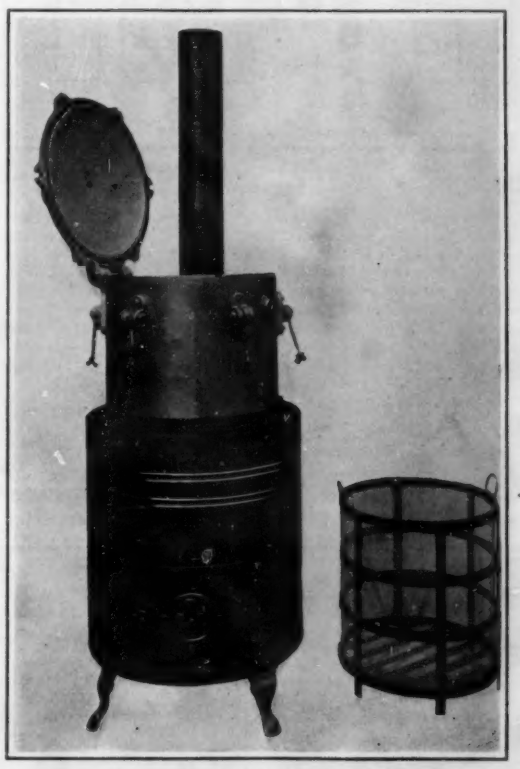
Home Canning to Prevent Food Waste

By C. L. Edholm

DOWN South the new slogan in the agricultural regions is "Every Home a Cannery" and the plan of establishing domestic canneries, coöperative plants for communities and a large number of small commercial canneries is spreading. It is a movement of importance, perhaps of vital importance at this period when the success of the Allies, with whom we are numbered, depends upon foodstuffs. Not only delicacies, such as fruits and berries, but substantial and strengthening foods will be canned this season, such as sweet potatoes, black-eyed peas with pork (quite as nourishing as the canned pork and beans) corn, English peas and string beans. Pumpkins, succotash, okra and great varieties of vegetables and fruits will be put up in compact and non-perishable form, and waste that heretofore has run into staggering sums will be eliminated.

A difficulty that has prevented extensive canning at home has been avoided by the development of a small size steam-pressure cooker. The boiling process known to most housewives will bring the products to a temperature of 212 degrees F., or less, according to altitude, but the steam pressure outfit raises the temperature to 250 degrees and a pressure of 5 to 15 pounds, thus destroying all bacteria and spores. By this method the spoiling of fruits and other canned goods, owing to imperfect sterilization is done away with, and the kitchen canner can be assured of successful results. This means a marketable product on a par with the output of commercial canneries, and the recently organized corporation of Atlanta which is putting the outfit into southern homes is also establishing a marketing system. This will solve another problem of the home canner, who is usually unfamiliar with the selling and shipping methods.

The steam-pressure canner for domestic use is small and inexpensive, yet it is substantially made and thoroughly effective in its results. The outfit comprises a steel retort and a cover that is hermetically clamped upon it, a thermometer gage to show the pressure, a safety valve for the protection of inexperienced users, a petcock or relief valve and a can crate or wire basket to hold the jars or cans. This is suitable for use on an ordinary range, and a porch or garden outfit for outdoor canning includes a sheet-iron wood-stove, which permits the housewife to escape from the heat of the kitchen and enjoy the breezes and shade while doing the work. This is indeed emancipation from drudgery, and will do a great deal to popularize home canning.



The home canner

The process by this method is much simpler than by the boiling method, and a great deal more certain in its results, there being little risk of spoiled fruit when the steam and pressure have destroyed the bacteria and spores. The novice is directed to use only first-class products (unless they are to be branded and sold as second-class) and to be careful about the purity of the water used and to see that all utensils are perfectly clean.

The cans are packed and placed either in the retort or a shallow water tank and brought to a temperature of 170 degrees. This process drives out the air and expands the contents. Immediately the cans are sealed, placed in the wire basket and lowered into the retort, with no loss of time. The lid is clamped down, the steam brought to the proper pressure and kept so for a certain definite time. Then the petcock is gradually opened, allowing the steam pressure to decrease slowly until when the gage registers zero, the retort may be opened with safety. After a brief interval the crate containing the cans is removed and the temperature is slowly reduced by dipping the cans into hot and then warm water. When glass jars are used instead of cans, especial care must be taken in the cooling process, to prevent breakage due to a sudden chill.

This in brief is the description of the steam pressure system as applied to the home, and it is simple indeed. Beside the outfit described above, the following articles should be at hand: A clock within easy range of vision large enough to show minutes plainly, a pair of accurate counter scales graduated from one ounce to 20 pounds, for weighing cans, sugar, salt, etc., a syrup gage or brine hydrometer for testing the brines and syrups, which vary in density for various products to be canned, and an abundance of clear hot and cold water. Fiber pails are preferred and the utensils should be just right, the pans thoroughly cleaned and the knives sharp.

An additional advantage to the thrifty housewife is the fact that the small steam-pressure canner is an all-year kitchen utensil. Not only in the canning season is it useful, but it serves as a steam cooker at any time. The fact that hens that are far from tender and the tougher and cheaper cuts of meat can be rendered appetising by the steaming process will go a long way toward paying for the first cost of the outfit. By its use, the flavor of food is retained that is lost by boiling, and so it is possible to serve more savory dishes and yet reduce the cost of the foodstuffs.

Articles which the housewife never thinks of preserving because of the difficulty and the risk of spoiling, can be canned safely with the steam-pressure method, which at last has been brought to the proper price and dimensions for home use. Meat, soup, fish, oysters, clams, etc., are preserved properly by this system, as well as the familiar fruits and garden vegetables.

A complete outfit for home canning

Conserving the food supply

How a Microbe Grows

By Maud DeWitt Pearl

THAT rejuvenescence by means of the union of germ cells from two individuals of the same type is essential for the continuity of life in all but the simplest organisms has long been an accepted fact. There has been no certain proof, however, in the case of the most minute and lowly organized forms that this principle also prevails, that is, that at intervals there must be a union of individual cells to form a recombination of protoplasm in order that the life of these cells continue.

Such evidence as we have had of the necessity for conjugation has come from the protozoa. Only recently has any testimony been obtained to show that bacteria also have a complex life history and are not so simply organized as has been supposed. Since their original discovery practically all that has been known about these miscropic creatures, which bear such an important relation to the most highly organized inhabitants of the earth, is that they exist as single cells, spherical, rod-like or corkscrew-shaped, or aggregates of such cells which increase in numbers by simple division. Recently two bacteriologists of the Department of Agriculture, at Washington, F. Löhnis and N. R. Smith, have made what may well be considered an epoch-making discovery in this particular field of science.

Bacteriologists have always been annoyed by what they term granulated dirt or slime in the preparations which they study under the microscope. Little have they realized that in this slime or dirt is to be found a very important phase in the life of bacteria. Instead of a microbe existing as a simple cell which multiplies indefinitely by fission, it is now shown, at least for those forms belonging to the forty species studied, that each bacterium lives alternately in an organized and an amorphous stage. The latter has been called the symplastic stage, because at this time the living matter previously enclosed in the separate cells undergoes a thorough mixing, either by complete disintegration of cell wall as well as cell content, or by melting together of the contents of many cells, leaving their empty cell walls behind them. It is the symplastic or disintegrated stage which is seen in the slime on the microscopic slide.

Another very important point which these workers determined is that the stages between the symplasms for any one bacterium are not similar. A bacterium passes from the cellular stage, perhaps spherical in shape, into the symplastic. Upon reforming it assumes a quite different shape from what it had in the previous organized condition. It then again becomes amorphous only to emerge next in an entirely new costume; and thus it goes on, each bacterium taking on numerous different forms in the alternating organized stages. Occasionally a bacterium during the course of its existence fails to turn into "slime" and then it changes directly from one organized form into another, but this is not of frequent occurrence.

This discovery of complexity in the life cycle of these minute forms will have a marked effect upon all phases of the study of bacteriology. Not only will medical and soil bacteriologists be greatly aided in their researches by these investigations, but the classification of bacteria can now for the first time be put upon a satisfactory basis. Hitherto the various sub-stages of a bacterium were considered as different varieties or species with the result that systematic bacteriology was in a chaotic state.

In explanation of why a bacterium does not live entirely independently but at intervals mingles its protoplasm with that of others, Messrs. Löhnis and Smith say: "The formation of the symplasm and the conjunction of the cells are nothing else than two modes of mixing plasmic substances temporarily enclosed in separate cells. Evidently the continuity and rejuvenescence of the living matter in the bacteria is just as much dependent on this process as is the case in all other organisms."

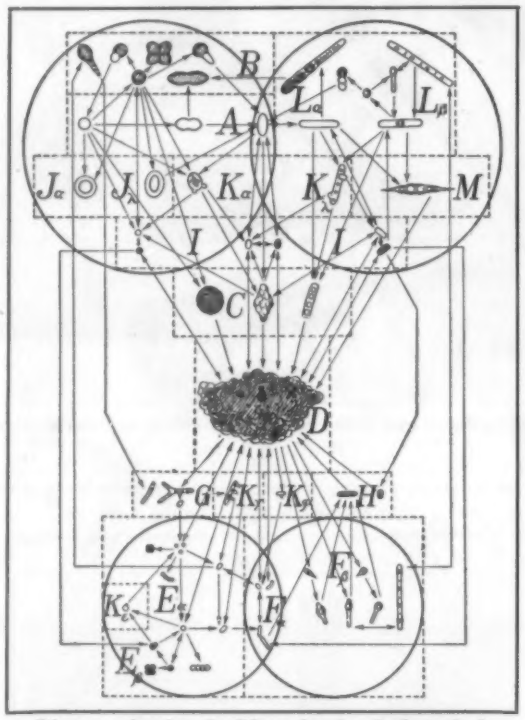


Diagram showing the life cycle of a single typical bacterium

The large irregular mass D represents the symplastic Stage. All other forms represent different organized stages through which the strain of this particular bacterium may pass. The arrows indicate the possible changes which may occur. While some of these changes from one sub-cycle to another are rare, the stage D occurs with great regularity. Those forms within the four large circles have been regarded in the past as being bacteria closely related to one another, while the four groups have been usually considered as bases for establishing separate species.

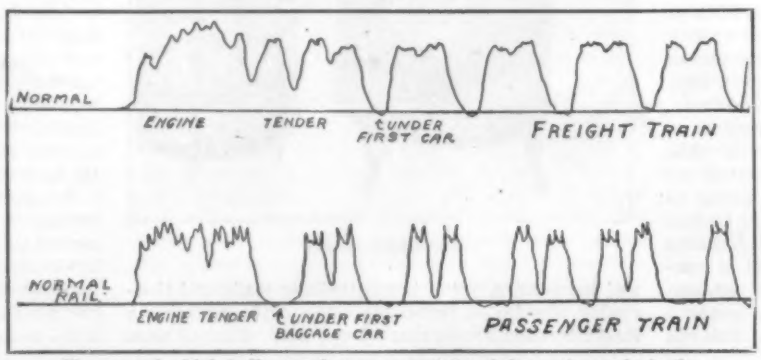
Why Railroad Tracks Wear Out

A Home-Made Apparatus Which Settles the Matter When Experts Can't Agree

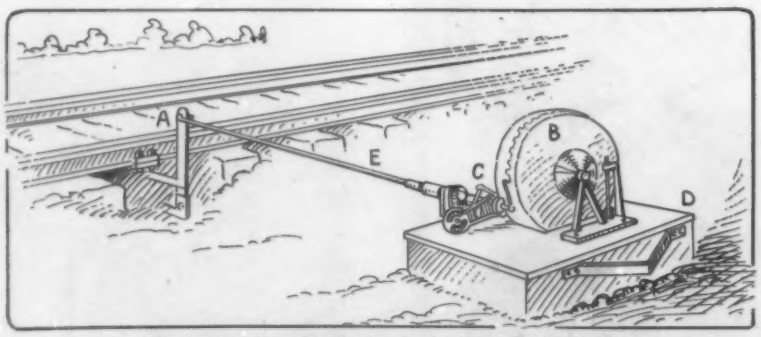
BY means of a home-made device rigged up in the Engineering Department of the Missouri State University, the Railway Commission of that State hopes to win a case in the Federal Court in which the Missouri Pacific Railroad attacks the two-cent passenger fare law.

The railroad claims that this fare is confiscatory, while the State maintains that it reurns a net revenue of 11 per cent. Practical agreement was reached between the company's engineers and the Commission's experts as to the physical valuation of road, rolling stock, etc., and the proper distribution of this capital investment between the passenger and freight branches of the service; but wide divergence arose as to the proportion of track maintenance expense that should be charged to each branch. This difference of opinion made all the difference between the State's estimate of 11 per cent profit and the company's claim of actual loss.

In arriving at their figures, the company's engineers applied what is known as the engine-ton-mileage theory. According to this, multiplication of the weight of the engine, with the tender, by the number of miles traveled, will give a figure proportional to the resulting wear and tear upon bridges, rails, culverts, etc. The assumption of course is that it is the heavy pounding of the driving wheels and the great concentration of weight above them that causes the really serious deterioration in the track and roadbed, and that damage from the comparatively smooth passage of the train itself, with its comparatively even distribution of weight, may be neglected.



The record which indicates that gross weight of the entire train is the determining factor in track deterioration



Missouri professor's device for testing effect of train passage upon rails

The State's engineers rejected this proposition as fallacious, insisting that the proper measure of wear and tear was only to be attained from a consideration of gross ton-mileage, in which the entire weight of each train is multiplied by its mileage to get a coefficient of depreciation. That is to say, all parts of the train put an identical strain upon the track, and the total damage done by the passage of any train is proportional to its gross weight and speed, rather than to the weight of the engine alone and the speed, as the company claims. It is clear that if this view be correct, the greater number and weight of the freight trains will far outweigh the greater speed of the passenger trains, and the freight service will have to bear a far greater proportion of the maintenance expense than if the other theory were the true one. This will of course reduce the passenger expense and make a lower rate practicable.

In proof of the soundness of its theory that wear and tear is a matter of the gross tonnage that goes over the way and structures, the State submitted photographs of tracings made by a specially devised machine. The roadbed was dug out for a short space beneath one rail, and to the under surface of this rail was attached an elbow joint made rigid by the lower end being gripped in a vise-like arrangement of plates. When a car passed over the rail this joint was depressed and a record of the deflection made upon a rotating paper-covered drum. The motive power of the drum was the clockwork motor of a discarded phonograph. It was admitted that an electrically driven arrangement would have given better satisfaction, as the clockwork was apparently affected by the cold weather prevailing.

A two-foot strip of brown print-paper upon which were shown the markings made on the drum by the passage of a 33-car freight train and also of a five-car passenger train, was presented in evidence to refute the argument of the company. The deflection of the rail under the two trains is practically the same, engine for engine and car for car; and accordingly it would seem that in view of the greater number of cars, the freight train makes far greater demand upon the rails. The only notable difference was that at the points of greatest deflection the passenger train curve was sharper than that given by the passage of the freight. This clearly arises from the fact that the passenger train traveled faster, so that the maximum deflection did not persist for so long a time.

The tracings present what resembles a series of exaggerated capital M's, the base line marking where the rail sprang back into place after the first pair of trucks had passed, and the central depression being formed by the small recession possible after the last trucks of one car had pushed the rail to the limit and before the forward trucks of the next one struck it. It should be remarked, for the benefit of the layman who looks at these graphs, that the height of the curve at any point is directly proportional to the force with which the corresponding point on the train pushed down on the rail. As this push varies, the curve oscillates.

Particularly interesting to the engineers whose curiosity caused them to flock to the office of the Commission to inspect the tracings, were the curves showing the deflection of the rail caused by the passage of the engines. The exact moment when the pony wheels and the drivers struck could be determined by the wave lines, which also showed the deflections caused by the tender. The railroad superintendent instantly noted, when he looked at the photograph, that the freight engine was unbalanced, and ordered it to the shops at once. This was shown by the deeper depression upon one side than upon the other and disclosed a condition that had escaped the critical eye of the round-house foreman.

The total weight of the passenger train was 440 tons; that of the freight train was 2,005 tons. The duration of the passage of the passenger train, running at 36.4 miles per hour, was nine seconds; that of the freight, running at 12.4 miles per hour, was 1 minute, 18 seconds.

The importance of the results obtained are thus summarized by an expert of the Commission. They prove the contention of the State that the wear and tear to track and roadbed is not confined to the heavier engines, but is accurately distributed between engines and cars upon a basis of gross tonnage. If the court holds, following this showing, that the gross ton-mileage theory is the correct one for apportionment of maintenance expenses, the charges will be divided 18.7 per cent against the passenger service and 81.3 per cent against freight traffic. If the railroad's formula were to be adopted the distribution would be 32 and 68 per cent. This difference represents approximately $50,000. If the State is sustained, the two-cent fare yields 11.4 per cent on the actual passenger investment. If not, the two-cent fare yields a deficit, and the three-cent fare must be substituted.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

Saving Labor in the Sugar Field

THE accompanying illustration shows a unique gasoline oil motor-driven sugar-cane harvester which is of great value to sugar planters. The machine weighs 5,500 pounds and for motive power is equipped with a 40 horse-power gas motor. The operative force consists of two men and the machine harvests the sugar-cane very rapidly. It cuts, strips tops and loads 150 to 200 tons of cane per day, doing the work of 75 men.

A sugar-cane harvester that reduces three operations to a single one

This gas power sugar-cane harvester cuts cane 4 to 5 inches lower than hand cutting, thus adding 10 per cent to the yield of sugar. This fact was fully demonstrated at the Louisiana Sugar experiment station, and on plantations, and by means of a recently added attachment, the machine tops each stock of cane at the right spot.

This new machine combines gas power with mule power. The machine itself is pulled along the cane row by mules being used. On the rear platform of the cane harvester is a gasoline engine. This engine furnishes the power which drives the machinery. The cane is cut off at the ground by means of a pair of revolving disk knives. Revolving steel brushes strip the leaves from the cane, while the knives at the top cut off the tops. The topping device is adjustable and "averages" the tops. It is set at the beginning of each row of cane for 6, 7 or 8 foot cane, or what ever the height may be.

It is said that this machine will cut, strip and top ten acres of cane in a working day. In cutting the cane off even with the ground it is estimated that the machine can save about 10 per cent of the sugar-producing end of the stalk. Cane growers do not dispute the fact that the "sweetest" part of the cane is next to the ground. In this regard this machine will be of great economic value, aside from what it may save in the way of time and labor.

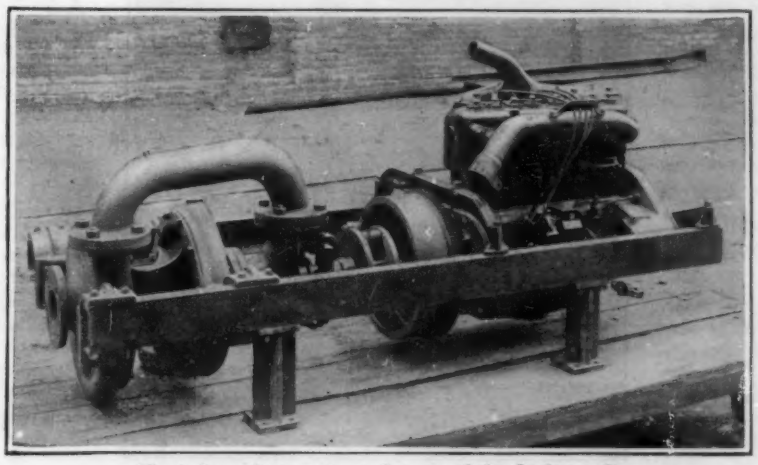
The cane will reach the wagon without being touched and this will in itself add to the value of the cane. Under present methods of handling cane much rubbish is picked up with the cane, which goes only to add to the cost of refining.

A Two-Motor Street Flusher

THE advantages of the flushing system of cleaning streets are so well recognized that this method of removing street filth has spread throughout this country and abroad. Where adequate water pressure is not available special flushing trucks are employed to displace the customary use of fire hose attached to hydrants. Even when the requisite hydrant pressure is to be had, it is clearly evident that there is greater economy of water and a capacity for much more thorough cleansing in the use of a motor driven flusher which carries the water to the point where it is needed and delivers it, at the most effective angle, through nozzles under the direct control of the operator. No such particular and diligent work can be done by the man with a hose, who tries to cover as much of the street as can be reached by the stream without altering his position.

The development of an efficient flusher has received a great deal of attention. One of the latest machines is illustrated in the accompanying photograph.

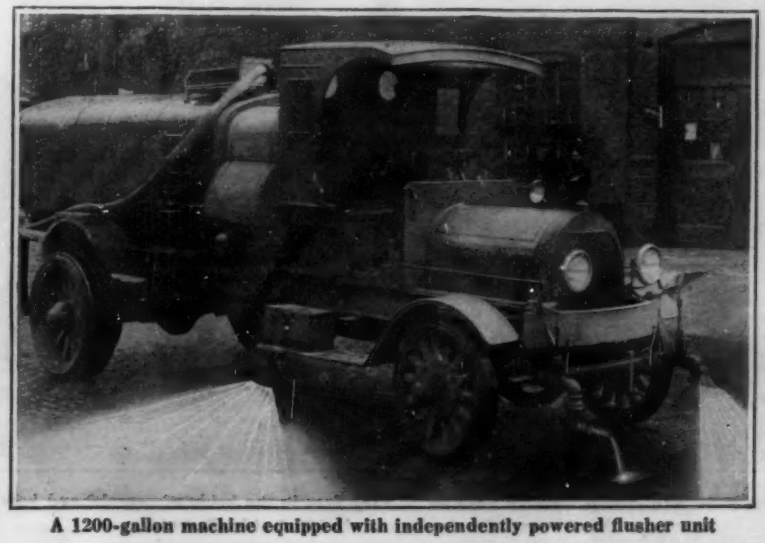
The underlying principle of this flusher is to have the motor truck and the flusher unit each complete in itself, so that the flusher could function perfectly as regards pressure and discharge of water even if removed from the truck chassis and placed on the ground or on a horse-drawn vehicle. The flusher unit has a separate gasoline motor of its own which operates a centrifugal pressure pump. This enables the operator to shape the course, alter speed and in every way manipulate the motor truck proper irrespectively of the flusher apparatus; and conversely, it also enables the operator to control the pressure of the water delivered on the streets or elsewhere absolutely without regard to the speed of the propelling vehicle. The operator can increase the water pressure, even while slowing down the vehicle, which heretofore has been impossible without changing the speed or the speed gears of the propelling vehicle. This type of construction also enables the builder to balance the power required for the two separate units in the most economical manner possible. For instance the vehicle motor can be operated on high speed (or on direct drive) wherever the condition of the streets permits. This naturally means economy in the use of both gasoline and oil for the propelling vehicle. Furthermore a motor may be selected to operate the pressure pump that is of ample power and not overpowered for the functions it must perform. The range of pressures obtained can be varied from a few pounds up to 60 or 70 pounds at the operator's will and is affected only by the number of nozzles that may be used or opened at one time. The operator can start his vehicle motor and the pump motor, open up the nozzles he requires to perform the work in hand, set his throttle for the pump motor at a point that will maintain even and constant pressure and proceed to his work. He can then, altogether independently, manipulate the propelling vehicle as conditions warrant, slow down for intersections, street car tracks or bad holes, change gears for grades, or coast on grades, and the pressure on the water that is being delivered to the streets will remain absolutely constant.



The independent motor and pump of the flusher unit

Flushing streams operated at any angle under direct control of the driver

Back of the driver's seat is the independent flusher power plant



A 1200-gallon machine equipped with independently powered flusher unit

A New Type of Rheostat That Is Convenient and Fool-Proof

AN improvement in rheostats, due to Prof. H. L. Dodge of the State University of Iowa, promises much in its coming commercial application. Among the advantages gained are: The new rheostat is easy to connect and nearly fool-proof; both series and shunt or potentiometer relations are secured by the mere opening or closing of a switch; all values of current and voltage within the limits of the source, the rheostat and the load are instantly available; and the new rheostat can be rated according to maximum voltage and current capacity of the source. The combination of these features in a single instrument makes a rheostat which will be found most desirable wherever convenience and flexibility of of current and voltage regulation is desired, particularly in the research and testing laboratory.

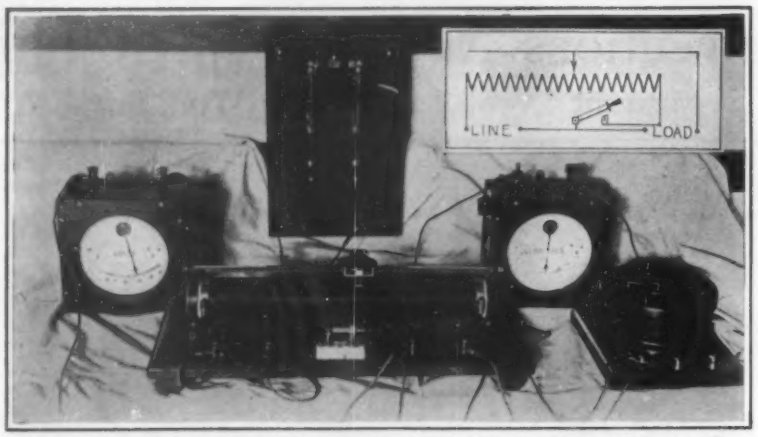
The convenience of the rheostat is due in part to the complete differentiation of the line and load terminals. The terminals being properly labeled, there can be no doubt as to the reason of connecting the instrument into the circuit; thus the instrument can be safely intrusted to inexperienced hands. Another fool-proof feature is that the instrument, being designed for certain maximum voltages, can be left on short circuit indefinitely, provided of course that the slider is near the full resistance end. In order to indicate that this is the safest position for the slider this end of the slider bar is stamped with the word "safe."

The accompanying diagram shows the the ease with which the change from either series or shunt relation to the other is made. If one traces the circuits he will find that when the switch is open the load is in series with that portion of the resistance to the left of the slider. When the switch is closed the load is shunted across that part of the resistance to the right of the slider and at the same time the whole rheostat is connected across the line. With the switch open, values of current up to

the full capacity of the rheostat may be secured. With it closed, small values of current and voltage, down to zero, are possible. Thus all values of current and voltage from zero to the maximum can be obtained. The way in which overlapping of the two ranges is provided for, no matter what may be the load, is one of the outstanding features of the Dodge design.

The ordinary type of rheostat rated by current capacity and resistance nearly always fails in one of three ways: Either it cannot be used at all in shunt relation, or if it can it will not give overlapping of ranges, or else it will give more than enough overlapping, which means loss of current capacity. The difficulty of obtaining the desired currents together with the inconvenience and loss of time in changing connections is familiar to everyone who has used such rheostats. With the Dodge design, however, all these shortcomings are eliminated. The winding of each size is carefully arranged so that for any load, *i.e.*, the worst possible load, there will be complete overlapping of current and voltage ranges and at the same time the maximum possible current capacity. If the rheostat has the proper voltage and current capacity any desired value of current or voltage can be secured in an instant.

For every voltage and size of tube—radiating surface and temperature rise, there is one winding and only one which will give overlapping for each and every load, and also yield the maximum current. The formulae for determining this winding have been carefully worked out and are followed in the manufacture of the new rheostats under Prof. Dodge's patent. The new rheostat is listed by voltage and current; the resistance is purely incidental. This, it is believed, is the only practical way to rate rheostats which are to be used for general purposes. While for permanent set-ups and special uses where wide regulation is demanded the old form of rheostat will serve if carefully chosen, where convenience and flexibility of control are factors the new design is certain to find wide application.



Delicate variations of current are possible with this newly-invented type of rheostat, which is wired as depicted in the insert drawing

A Machine That Puts Loose Change In One's Hand

COINS are a most unhandy form of currency at times, especially when one receives them as change over the counter of a store or restaurant, or on the ledge of a ticket-seller's booth. Indeed, with gloves on it becomes almost impossible to pick up the coins, and one is often obliged to remove the gloves as a preliminary to the work of picking up change. So keenly has the need for better methods of handling change been felt in instances where large quantities of coins are handled, that all sorts of devices have been resorted to, particularly scoop-shaped troughs in counters and ledges; but even with these it is difficult to grasp the coins.

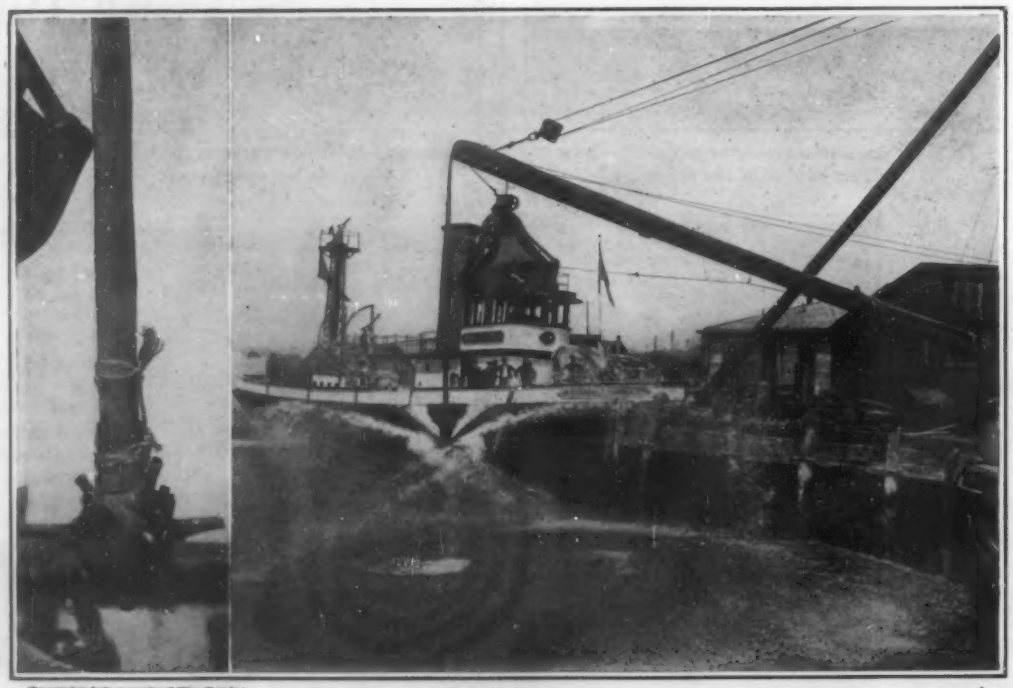
A change-handling device which places change directly into the palm of the hand has recently been placed on the market, and it appears that all the objections to former methods have been overcome in the present. It will be noted in the accompanying illustration that the new device consists of a bowl member into which the change is placed and held until a small trap-door in the center is opened by an upward pressure of the hand held in position to receive the change. The model shown is intended for use on a counter; and for other purposes, such as incorporation in the ledge of a ticket-seller's booth and in connection with a change-making machine, the same general principle can be readily applied.

This machine simplifies the handling of change by placing coins directly into the palm of the hand

A Marine Fire-Fighting Hose Which Does Not Have To Be Aimed

FOR fighting fires in the hold of vessels, Chief Hefferman of New York city has designed an ingenious multiple-nozzle hose which is simple lowered into the blaze and left there until its task is accomplished. In other words, this nozzle does not have to be aimed, as is customary with the usual fire-hose.

Chief Heffernan's device consists of a spherical end-piece for the usual hose, provided with a plurality of standard nozzles. The spherical member is loosely held on the hose so that it is free to revolve under the action of the water. Thus, when the multiple-nozzle hose is dropped into the burning hold of a ship, the streams of water form a circular curtain over 100 feet in diameter, and every foot of surface within the circle is profusely covered with a portion of the 16,000 gallons of water passing through the hose every minute.



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The recently-devised multiple-nozzle hose for fighting fires in the holds of vessels, and how it directs the streams of water in a circle 100 feet in diameter

The Current Supplement

THE building of ships is a matter that is of importance to the entire civilized world, and everything connected with the subject is of interest. *The Science of Naval Architecture*, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2164, for June 23d, is a valuable and able review of some of the fundamental principles of the art. *Armored Cars being Developed in America* is a note on cars belonging to the New York State Militia. It is accompanied by two photographs of militia maneuvers. *The Chronazimeter* describes and illustrates an apparatus designed in France for electro-diagnosis. *With Everyday Birds* discusses some peculiar problems of their home life. *The Classification of the Helium Stars* considers the different views of the order of celestial evolution. *The Fly Menace* is a reminder of the necessity of individual activity in eliminating these pests. It is illustrated by four excellent photographs. *The Planetary Origin of Water* sets forth a theory developed from the work of many investigators. *Further Study of the Atomic Weight of Lead of Radioactive Origin* discusses an investigation of the atomic weights of four samples of isotopic lead not hitherto tested. *Ball Mills for Grinding Ore* describes and illustrates one of the newer forms of grinding mills of ingenious operation. *The Influence of Speed on Endurance Tests* is an investigation of the cyclic application of stress on iron and steel, and is accompanied by diagrams. *Polarized Light in Vegetable Histology* describes some interesting investigations of plant tissues. *The Share of Egg and Sperm in Heredity* discusses some Mendelian problems.

Clothes from Peat

A VERY interesting and economically valuable invention, in the field of "substitute materials," has recently seen the light in Sweden. A process has now been perfected there for the manufacture of a strong textile material from peat fiber. The inventor, an engineer by the name of Jegeäus, of Götesberg, began to study this process as long as 20 years ago but, so far, his methods were hampered by the drawback that the process of manufacture was much too costly; he was therefore unable to turn his idea to any practical use. Induced by the war, however, he resumed his experiments, and has now at last succeeded in making dress materials from peat on a large scale. These peat fabrics are somewhat cheaper than those of artificial wool, and they are said to be of great durability. At the moment of writing the inventor himself and several other persons are already wearing "peat" clothing. A factory for the working of the process wholesale is about to be erected.

A New Alloy of Unusual Properties

THE latest thing in alloys is one of aluminum and calcium and unusual properties are claimed for it. By combining about eight to ten per cent of calcium with about ninety per cent of aluminum, an alloy is obtained which is claimed to be lighter than aluminum itself and to possess machining properties excelling aluminum or any of its other alloys. It is suggested as especially valuable in the metal industries, particularly in the manufacture of light castings for automobiles or airships. Such castings should have low specific gravity, good machining properties and freedom from brittleness; they should be capable of taking the finest impressions from the mold. The new alloy is said to fulfil all these conditions.

In the ordinary aluminum castings of today, it is necessary and customary to introduce a hardener such as copper, tin or zinc, aluminum itself being too soft to machine or cast properly. But hardeners increase the weight, tend to cause brittleness and in some cases the resulting alloys are less resistant to corrosion. The new aluminum-calcium alloy is from five to twenty per cent lighter than aluminum or its ordinary alloys; is much harder and more resistant to corrosion, and machines easily. The calcium also acts as a purifier and prevents the formation of oxide while the castings are being made.

This alloy cannot be made by simple fusion of the mixed metals because calcium itself burns, even when heated at a low temperature. To make the alloy, calcium in small pieces is pushed under the surface of the melted aluminum and held there until melted.

NEW BOOKS, ETC.

SIX MAJOR PROPHETS. By Edwin E. Slosson, M.S., Ph.D. Boston: Little, Brown and Company, 1917. 8vo.; 324 pp.; illustrated. Price, $1.50 net.

It would be hard to specify a single volume from which the reader might more quickly get an adequate view of the men and the philosophies that are molding the thought of the modern world; certainly there is no book which conveys this knowledge in a more enjoyable way. In it we are introduced to George Bernard Shaw, the dramatic critic of life; to H. G. Wells, the scientific futurist; to G. K. Chesterton, the knight errant of orthodoxy; to F. C. S. Schiller, the British pragmatist; to John Dewey, the teacher of teachers; and to Rudolf Eucken, apostle of the spiritual life. The interpretation is wholly sympathetic, the criticism fair and not unenlivened by genuine humor; in short, the literary editor of *The Independent* has given us a splendid guide to six of the most noted authors and teachers of the day.

PETS. Their History and Care. By Lee S. Crandall, Assistant Curator of Birds, New York Zoological Park. New York: Henry Holt and Company, 1917. 8vo.; 384 pp.; 138 illustrations from life. Price, $2 net.

We seldom find a child that is not attracted by animals; the trouble is rather that pets are enthusiastically installed in house or garden before any knowledge of their habits and requirements has been acquired. As to origin and history, that is rarely bothered about, although this knowledge would vastly increase the child's pleasure in, and understanding of, their pets. In this volume, a man who undoubtedly is qualified by successful practical experience imparts his knowledge to others in a chatty, readable way. There are the most interesting facts concerning mammals, birds, reptiles and fishes, with instructions for their care; an appendix gives the theories of breeding. The illustrations have been chosen with rare judgment, and with a view to showing different breeds and species of the various animals and birds.

A BRIEF ACCOUNT OF RADIO-ACTIVITY. By Francis P. Venable, Ph.D., D. Sc., LL.D. New York: D. C. Heath & Company, 1917. 12mo.; 62 pp.; illustrated.

A course in general chemistry that did not contain the facts and deductions of radio-activity would today be regrettably incomplete; yet many textbooks content themselves with so scant a mention of this important subject as to leave the student ignorant of some of its most vital relationships. Dr. Venable here collects the lectures with which he rounded out the course in general chemistry in the University of North Carolina, and his crisp discussions of the radiations, the changes in radio-active bodies, the alpha particle, the structure of the atom, and the influence of these related facts upon chemical theory, make up a treatise whose usefulness extends beyond the classes and commends itself to all who have but a limited time to give to the subject.

THE PLATTSBURG MANUAL. A text book for Federal Training Camps, with a foreword by Major-General Leonard Wood, U. S. A. By Lieutenant O. O. Ellis, U. S. A., and Lieutenant E. B. Garey, U. S. A., New York: The Century Company. 8vo. 303 pages, Index 155 illustrations. Price, $2 net.

The literature of the war is enormous in volume, and of the total, at least so far as American literature is concerned, not a little has been devoted to the subject of preparedness. We are all familiar with that patriotic and highly efficient enterprise, the Plattsburg Camp. It was the first practical expression of the determination of the people of this country to take the initiative in preparation for defense and show what the public itself could do, even if its Government would do nothing. The scope and purpose of the book is aptly expressed in the first paragraph of the preface: "This book is to tell the man who is going to Plattsburg, or to any Federal Training Camp, what he should know. Its further purpose is to offer a means of review to the man who has attended any Training Camp and to start him, if he so desires, along the correct road for a commission in the officers' Reserve Corps." The principles of the art and science of war are many and complex, and this book selects for the student the most important principles and facts, and omits the non-essentials. The beginner is told what steps to take to attend a Federal Camp and how to prepare himself physically. It carries him through the first month; then advises him what to do and what not to do, and how to get the most out of the short time that he is in camp. This covers the first part. In the second part, or supplement, is given a more technical discussion of the subjects with which the student has already been made broadly acquainted. This section has been written principally for those who have made especially good progress, and for the Officers' Reserve Corps men. We cordially commend this excellent work. It has the two great advantages of being printed in very clear and easily readable type, and of being exceedingly rich in illustrations. These latter are so good that, with this book in his hand, the reader can get a practical conception of soldiering before he goes to the recruiting office. We predict a very extended sale for this most excellent work. Not only should it be in the hands of every man who goes to a Federal Training Camp; but it can be most profitably read by every patriotic citizen who is interested in the preparedness movement.

THE NATURE OF MATTER AND ELECTRICITY. An Outline of Modern Views. By Daniel F. Comstock, S.B., Ph.D., and Leonard T. Troland, S.B., A.M., Ph.D. New York: D. Van Nostrand Company, 1917. 8vo.; 225 pp.; illustrated. Price, $2 net.

There are in existence numerous works that deal with phases of this subject, but until the present volume appeared there was none that dealt with the whole theory of matter and energy in an elementary and popular way with the aim of revealing to the reader the essential unity that underlies apparently diverse physical sciences. An imaginary microscope of enormous power is postulated, and by its aid the reader is given at least a symbolical idea of the arrangement and relative size of the atoms and molecules of various substances. Of the two parts into which the volume is divided, the first presents a broad, schematic view of the structure of the material universe as modern science has come to visualize it; the second part covers the same field, but with more attention to detail. If only the fundamentals of the modern theory are required, Part I will provide a clear general understanding the more conscientious student will find in Part II a richer knowledge and much valuable reference material. As a timely outline and summary of present-day conceptions, the work will be found to be dependable and illuminating.

WINTER TRACK WORK. By E. R. Lewis. Chicago: Railway Educational Press, 1917. 8vo.; 157 pp.; illustrated. Price, $1.60 postpaid.

SIMPLIFIED CURVE AND SWITCH WORK. By W. F. Rench, Supervisor, Pennsylvania Railroad. Chicago: Railway Educational Press, Inc. 16mo.; 206 pp.; illustrated. Price, $1.50 postpaid.

Dedicated to "that most faithful and deserving railway employee, the American trackman," Mr. Lewis's sympathetic manual embodies the track department experiences of 20 years. Track is very sensitive to weather, and the trackman must know just what effect weather changes will have upon his work and how to forestall trouble. The author believes the trackman should be furnished not only with the train schedule but also with the best weather forecasts obtainable. Succeeding chapters deal specifically with frost, snow, shims and shimming, the force, tools and supplies, snow sheds and fences, snow handling equipment, and spring floods. "Simplified Curve and Switch Work" enters another important field of railroad activity and offers comparatively uninvolved methods for the solution of curve and switch problems. Both typical and unusual conditions are dealt with in simple arithmetical relations capable of being understood by the intelligent track foreman, and resulting in a saving of time and labor. Among the questions discussed are the realignment of curves, the determination of superelevation, the easement and siding layout. The work is also well adapted as a supplement to college engineering courses, for in this kind of work rules founded upon theory alone often fail when actual conditions are confronted.

DRAWING AND DESIGN FOR CRAFTSMEN. By R. S. Bowers. Philadelphia: David McKay. 8vo.; 415 pp.; illustrated. Price, $2 net.

FURNITURE MAKING. By R. S. Bowers, John Bovington, and other designer-craftsmen. 8vo.; 415 pp.; illustrated. Price, $2 net.

With these two excellent volumes, the Handcraft Library makes its initial bow to the public. "Drawing and Design for Craftsmen" is a manual for the self-instruction of those interested in any of the artistic industries. It takes up freehand and geometric drawing, brushwork, designing and pattern-making, lettering, perspective and numerous other divisions of the illustrative art, with hints touching upon work in wood, leather and metal. The work of 30 different artists is shown, each drawing being selected with a view to making manifest the basic principles besides suggesting motif, style or treatment in its application to a certain class of design. "Furniture Making" offers a most artistic variety of pieces, and specifies the tools and presents the knowledge necessary to the satisfactory execution of the work. Sufficient detail is in each case given to ensure thorough understanding, but some elementary knowledge of cabinet making is assumed. No less than a hundred and seventy examples of tasteful furniture are to be found in the volume, representing the contributions of many successful designers and craftsmen.

THE THEORY OF EVOLUTION. With Special Reference to the Evidence upon which it is Founded. By William Barryman Scott, Ph.D., Hon. D.Sc., LL.D. New York: The Macmillan Company, 1917. 8vo.; 183 pp.; illustrated. Price, $1.

Prof. Scott here combats the spreading belief that the theory of evolution is moribund, and strives to correct the misapprehension that has arisen from the misinterpretation of minor disagreements between zoologists and botanists, and from the loose application of the term "Darwinism." For the benefit of the general reader he outlines the evidence upon which the doctrine of evolution is founded, as far as possible avoiding technical language. He does not confine this evidence to classification and comparative anatomy, but extends it to embryology and blood tests, to palaeontology, to geographical distribution, and to the knowledge gleaned from actual experiment.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of SCIENTIFIC AMERICAN.

Pertaining to Apparel

SECTIONAL HAT BOX.—J. B. MACON, Rector, Ark.—The improvement pertains to hat boxes, and more particularly to a sectional box for storing and shipping hats. One of the principal objects is to provide a box composed of individual removable sections, adapted to each support a single hat, said sections acting each as a cover for the one immediately beneath.

NECKTIE FORMER AND FASTENER.—W. F. OLSON, 136 N. 31st St., Omaha, Neb. This invention relates to a device particularly adapted for use with turn-down collars and arranged to constitute means on which a four-in-hand tie may be formed. It provides a simple device for the indicated purpose which may be detachably secured to the collar independently of the collar button.

ADUSTABLE HAT LINING.—F. GRUNIG, care of Pullastic Co. of America, 49 E. 21st St., New York, N. Y. The object of this invention is the provision of a new and improved hat lining arranged to permit of readily fitting the lining to hats of different sizes, different crown depths and different shapes and to enhance the appearance of the interior of the hat.

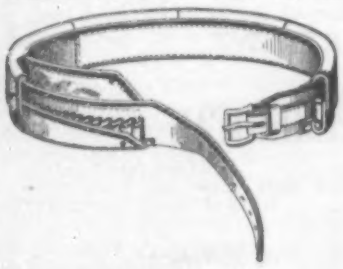
CORSET.—LORETA A. CIRILLO, 202 Bleecker St., New York, N. Y. This invention supports the weight of the abdomen from the region of the back above the waist line; maintains the lower edge of the abdomen-supporting member below the abdomen when in service; shapes the abdomen-supporting member; restrains the flesh above the top of the corset; and provides removable devices for so restraining the flesh above the top of the corset adapting the corset for formal or ordinary wear.

GARTER.—H. A. RODRIGUES, 34 Wrightson Road, Wood Brook, Port of Spain, Trinidad, British West Indies. This improved garter for supporting legs of socks or stockings is distinguished by a novel and simple construction and

GARTER

combination of parts which permit easy and quick application and adjustment of the garter, and render it comfortable for the wearer. The metal parts of the garter may be made of, or covered with, a non-corrosive material.

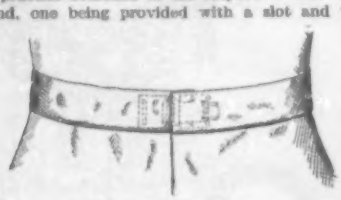
CARTRIDGE BELT.—F. G. HIMELSPACH, 502 E. Main St., Trinidad, Colo. This belt is particularly adapted for containing dynamite fuse caps or other rimless cartridges, the construction being such that the belt may readily



CARTRIDGE BELT

adapt itself to the contour of the body of the wearer, and will also thoroughly protect the contents of the belt from shocks or jars and entrance of foreign matter, such as coal dust, sand, etc., to the contents of the belt.

SKIRT BAND FASTENING.—N. KLAUS and E. W. BOOKHART, Breda, Iowa. This device is invisible or concealed from view when being worn. It comprises two rigid plates, which are in practice attached to the respective ends of a band, one being provided with a slot and the



SKIRT BAND FASTENING

other with a catch adapted to engage in the slot, and a plate spring which prevents contact of the clothing with the said catch or hook and increases friction and security of engagement of the latter with the slotted plate.

HAND PROTECTOR.—D. S. CURTIS, General Delivery, Butte, Mont. In this case the invention relates to a protector for the front of the hand and adapted for use by market men in handling various material, as well as barrels, boxes, etc., and by workmen generally, in the handling of rough or hard materials.

PROTECTIVE LINING FOR GARMENTS.—M. I. GRENBERG, 112 Madison Ave., New York, N. Y. This invention is an antiseptic "protecto-slip" which is to be attached with a seal to the linings of ready-made gowns and blouses in such manner that the real lining of the

PROTECTIVE LINING FOR GARMENTS

gown never comes in contact with the persons who try on the garment. The seal remains unbroken until the garment is sold. When the slip is removed the one who buys the gown has the satisfaction of knowing that the lining has come in contact with no one else.

CUFF LINK.—C. A. RIEMER and B. HENDRICKS, 924 W. End Ave., New York, N.Y. This invention provides such articles of wear which will permit pulling the cuffs of a shirt up on the arms to or above the elbows without the necessity for detaching the links from the cuffs as is necessary with the conventional links, and which in any adjusted positions of the cuffs on the arms, tensionally hold the cuffs thereat.

PAJAMAS.—J. P. VAN KIRK, Bradley Beach, N. J. The pajamas have trousers and coat in one piece to allow convenient donning of the garment, and are provided with a sanitary drop seat adapted to be conveniently opened and closed without the use of buttons or other undesirable projecting fasteners, so that the user is not inconvenienced by such fastening devices.

Pertaining to Aviation

PROPELLING DEVICE.—H. E. ROSE, 602 5th Ave., College Point, N. Y. The invention refers more particularly to propelling devices for aeroplanes. It provides a device in which a plurality of movable blades or wings is so mounted that, when the blades move toward the rear of the device, a greater surface area is presented than when they move toward the front, thereby propelling the device forwardly.

Electrical Devices

ROTARY PUMP.—W. J. Wilson, Petersburg, Ind. This invention provides a portable fluid pump primarily designed for the use of dentists and physicians, as for spray-bottles, blow-pipes, or other devices requiring air under pressure, although for liquids also; provides a pump which is inclosed within the rotor of an electric machine; and provides such a pump which will deliver air under constant pressure, due to the absence of piston reciprocation, in which the pressure of delivered fluid may be under control.

SHUTTER OPERATING DEVICE FOR CAMERAS.—T. KRUGER, 210 Sumner St., Peoria, Ill. This invention provides a device by means of which a camera may be operated from a distance so that the ower of the camera may include himself in a group, after setting the camera in proper focus. It provides an electric device for operating the shutter of a camera thereby obviating the necessity of using long cords or other similar mechanical devices, as when photographing wild animals.

TEMPERATURE SIGNAL FOR STACKS.—W. R KLECKNER, Via Bay Point, Cowell, Cal. The invention relates to an electrically-operated signal for indicating a predetermined maximum temperature of gases within a stack, and also when an excessive fuel consumption begins. It provides a device adapted to control a normally open switch of an electric circuit in which audible and visible signals are provided.

TELEPHONE TRANSMITTER AND MOUTHPIECE.—H. NAKAI, care of Oriental Trading Co., Havre, Mont. This invention supplants the conventional mouthpiece by an inexpensive, destructible mouthpiece for each user of a telephone, in other words, compels the use of the sanitary mouthpiece on the part of careless telephone users who would otherwise use any mouthpiece which might be on the telephone.

ELECTRIC CONNECTION FOR RAILWAY VEHICLES.—L. BOIRAULT, 58 Rue Taitbout, Paris, France. This apparatus insures the electrical coupling of any number of conductors at the ends of the carriages, particularly in electric trains comprising a plurality of automotor vehicles. The connections are obtained by means of split pins which frictionally enter corresponding sockets, the pins being carried by a portion of the apparatus which is mounted upon one of the carriages and the sockets being carried by another portion of the apparatus which is mounted upon the adjacent vehicle.

Of Interest to Farmers

PNEUMATIC STRAW STACKER.—V. N. PERRY, 538 E. Main St., Batavia, N. Y. This invention provides a grain saving-device whereby all grain that passes over the sieves or separating racks is separated from the straw by being forced through suitably arranged grates in the bottom of the pan caused by the centrifugal action of the fan. This saving device is especially suitable for bean and pea threshers as all pods left unthreshed by the threshing cylinders are usually threshed by the stacker fan and discharged with the straw. The grate in this stacker provides a simple means for preventing this great waste.

COTTON GIN.—W. T. DODD, 200 Broadway, New York, N. Y. This invention provides a gin with parts disposed to obtain a more thorough cleaning of the cotton than is possible with cotton gins now in use, and to treat and straighten the cotton fibers. Among other advantages are to construct the ginning rolls of fiber board disks clamped to shafts and provided with spiral grooves; to construct the knocker rolls each of one piece of metal with projecting teeth; and to provide new means of adjusting the doctor blades relatively to the ginning rolls.

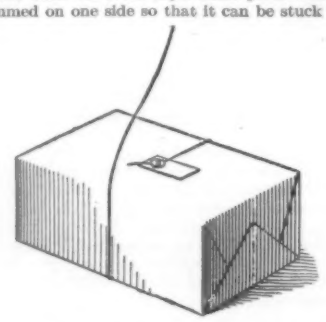
DIVISION PLATE FOR EGG CASES.—C. J. VOORHORST, 515 College St., Portland, Ore. The object here is to so form a plurality of division plates as that each of the upper plates of a series will support its layer of eggs and be in turn supported by the layer of eggs immediately below the same, the eggs being so held as that their proven strength in each layer will support superposed layers thereabove.

Of General Interest

CONCRETE ARCH FORM.—T. R. ANDERSON, 330 E. 5th St., Oklahoma, Okla. This improvement provides span members which are readily adjustable to spans of different lengths having the same radius for the arc of the arch. It provides coöperating angle bars for sustaining the span members during the arch construction and provides means for quickly and easily installing said span members and for as readily removing the same after the arch is built.

HAND BAG.—L. WOLF, 50 E. 9th St., New York, N. Y. This invention relates to ladies' hand bags, and the main object thereof is to provide a bag adapted for different occasions or for different dresses by making the bag reversible to present either of two outer coverings, which may be of different colors, or of different designs and of different materials.

PACKAGE SEALER AND FASTENER.—H. C. MARSTON, 173 Murray Ave., Goshen, N. Y. The very specific object of the invention is the provision of a fastening device in the form of a paper, linin or other equivalent piece which is gummed on one side so that it can be stuck to a



PACKAGE SEALER AND FASTENER

wrapper or package, either as a seal therefor, or to attach the device to the package so that a tie string can be attached to the device for enabling the package to be secured, by the string, there being on the gummed piece a button with which the tie string is engaged.

COLLAPSIBLE BUCKET.—G. B. SEXTON, 516 Broadway, Long Branch, N. J. The present improvement relates generally to buckets and more particularly to a collapsible bucket intended for use as an army water pail or as a handy camping automobile and motorcycle pail, and the object is the provision of a simple strong and serviceable construction formed of canvas, leather, or any material capable of holding water and sufficiently flexible in its nature.

FLEXIBLE SLEEVE FOR STAY BOLTS.—A. G. RUBER and C. H. PORTER, 65 Manning Boulevard, North, Albany, N. Y. The invention relates to sleeves used in connection with stay bolts, and particularly stay bolts of the kind used in boilers where the changes due to expansion and contraction of the various parts of the boiler are apt to subject different parts of the boiler to undue strains, and thus tend to cause leakage.

CONCRETE BRIDGE CONSTRUCTION.—H. L. PEGRAM, Mulvane, Kan. This invention relates to means for building reinforced concrete bridges, and the main object is to provide a system of reinforcing which also carries the load of the bridge, including the concrete, in separate truss formation, together with the mold ready for pouring the concrete.

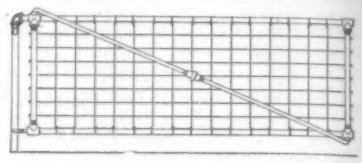
CIGARETTE CASE.—G. T. MORITS, 20 Maiden Lane, New York, N. Y. The case has a lid which carries the cigarettes, the ends of the cigarettes being disposed in the body of the case when the lid is closed, so that when the lid is freed by a catch on the body, the lid will be thrown forwardly by a spring, and with it the cigarettes, to permit of the convenient withdrawal of the cigarettes from the lid.

ENDLESS WEB BELT.—W. ACHTMEYER, 29 Wall St., Middletown, Conn. The purpose here is to provide an endless web belt made from a single piece of webbing joined at the ends without the use of special fastening or coupling devices and arranged to present practically a uniform thickness throughout the length of the belt and without any undesirable projections on either face especially at the joint.

WEB FASTENER.—W. ACHTMEYER, 29 Wall St., Middletown, Conn. The invention provides a web fastener more especially designed for fastening the web brake shoes, or web linings to cone clutches, and arranged to securely hold the web in place, and without any portion of the fastener projecting onto the weaving or contacting face of the brake shoe or lining.

SAFETY GAGE GLASS.—G. ERNST, 44 Oakland Terrace, Newark, N. J. Among the objects of this invention is to simplify this type of device and improve the same in several important parts, having reference especially to increased safety, plainer legibility of the water level, and facility for adapting the gage device to differently-spaced stuffing nuts.

GATE.—C. WINTER, Oskaloosa, Iowa. This invention provides a construction which may be easily adjusted by moving certain parts so as to continually maintain a tension on the wires and



GATE

other members making up the body of the gate. It provides a gate in which the rotation of certain of the members in a given direction will tighten the wires of the gate and in an opposite direction will loosen the wires for the purpose of repair.

METAL BUILDING PLATE.—LIZZIE H. DICKELMAN, care of Dickelman Mfg. Co., Forest, Ohio. This invention provides a plate which may be used for foming corn cribs, storage bins, or other similar structures where ventilation is necessary. It provides a plate having means for ventilating the structure of which the plate forms a component part, and also means for preventing the entrance of rain or snow.

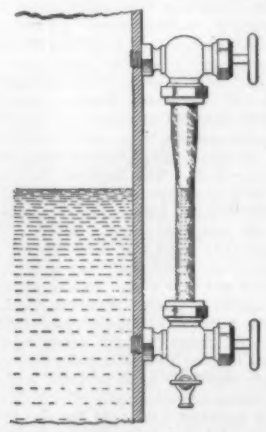
SPARK PLUG.—J. J. SMITH, JR., 77 W. Napier, Benton Harbor, Mich., Route 1. This invention provides a spark plug having removable terminal points, whereby, when the latter are fouled they can be removed and be replaced by clean tips. It provides a spark plug having removable tips, said tips giving a greater sparking area than the ordinary terminal.

COMB.—E. MCG. JONES, R. F. D. No. 3, Winchester, Ky. This invention relates more particularly to a fountain comb adapted for use in the treatment of the hair and scalp. It provides a hollow body portion through which is fed air under pressure and medicinal compounds, such as salve and ointments, for distribution to the several teeth of the comb whereby hair and scalp may be effectively treated.

SUBMARINE MINE AND PROPELLER ENTANGLEMENT.—A. N. MCGRAY, 119 W. 71 St., New York, N. Y. This invention provides a defense or a system of protection for coasts, harbors and the like, the defence embodying submerged elements floating a suitable depth below the surface of the water and serving as entanglements for the propellers of war crafts, whereby the latter will be rendered helpless against escape and exposed to the attacks of the enemy.

YEAST SUBSTITUTE.—J. O. LUMSDEN, 2708 Washington St., Seattle, Wash. This yeast substitute accelerates formentation and causes a thorough and quick incorporation of carbonic acid gas on the dough formed; expedites the handling of the dough and permits the baking of the dough within an hour after the mixing of the ingredients which constitute the dough. It increases the keeping quality of the bread.

GAGE GLASS FOR STEAM BOILERS.—T. L. PETERSON, 327½ 17th St., Brooklyn, N. Y. This invention improves gage glasses in such a manner as to considerably prolong the life thereof by making the upper end of the glass with a wall or considerable thickness compared with



GAGE GLASS FOR STEAM BOILERS

the intermediate portion and lower end of the glass, so that, notwithstanding the corrosive action of the steam, the glass will last as long at the upper end as at the lower end approximately, thus reducing the number of blowouts in a given period.

(Continued on page 628)

Lumber for the War

IT is estimated by the Council of National Defense that two billion feet of lumber will be needed for purposes directly connected with the war during the next year. Of this, five hundred million feet will be used to build the army cantonments and four hundred millions for the shipbuilding program.

Dairy Preparedness

(*Concluded from page 621*)

etc. In connection with this work circular letters to milk-plant operators are issued every month, dealing with problems confronting milk dealers and giving information looking to the increase of efficiency in handling and distributing milk.

As might be expected of a movement of this character, the distribution of printed matter forms a not unimportant part of the labors of this branch of the government, and pamphlets on many related subjects are constantly being sent out. Valuable treatises on the dairy herd and its management, the feeding of dairy cows, feeding and management of dairy calves and young livestock; the farm cow with special reference to southern conditions, making farm butter, cow testing associations, production and care of milk and cream, how to remove garlic flavor from milk and cream, how to judge a dairy cow, clean milk and how to produce it; bacteria in milk, fermented milks, ice on the dairy farm, steam sterilizers, the small dairy house; making and feeding of silage, home made silos, conveniences in handling farm cows and products, eradication of cattle ticks, tuberculosis in animals, milk fevers, foot and mouth disease, etc., etc., are to be had for the asking.

But the activities of the Division are not confined to the investigation of problems and the giving of advice. It supervises for the Navy Department the manufacture of from 500,000 to 1,000,000 pounds of butter each year, all made from sweet, pasteurized cream. It is required that the butter must contain not more than 13 per cent moisture in tins or 14 per cent moisture in tubs, and the salt contained must be between 2.5 and 3.25 per cent. A Dairy Division inspector sees that these specifications are met. Most of this butter is packed in 5-pound, lacquered, hermetically sealed tin cans. So good is this supervised butter that even after eight months in storage at 10 degrees below zero, it undergoes but little deterioration.

The activities of the Dairy Division are divided into dairy farming, dairy manufacturing, dairy research laboratories, market milk, dairy experimental farm (at Beltsville, Md.) and the western office (at Salt Lake City). Most valuable of all its many activities is its attitude toward the dairyman, the butter maker, the cream producer, the man interested in dairy products from any angle. No question which can be asked the Dairy Division but will have a complete and illuminating reply. The whole feeling of those in charge is that of a desire to increase production, decrease cost, make quality better, produce a healthful product, show a profit for the dairyman. The Division stands, if not in *loco parentis*, at least, as first friend to the puzzled owner of cows, prepared to help him with any problem from the selection of a churn to the eradication of foot and mouth disease. By providing a central bureau of exact scientific knowledge, based not only upon exhaustive laboratory investigations in the hands of trained scientists, but upon actual experiments upon model farms, the Dairy Division does for the man with a cow what no other association can possibly do, and puts back of Bossy, back of the milk jar and the butter pat, the resources and the knowledge of the United States Government.

In time of war the effect of such economic preparedness would unquestionably be of great value, but in time of peace, these activities are of even larger importance, inasmuch as they look toward the increase of per capita wealth, and the spread rather than the contraction of the dairy industry.

RECENTLY PATENTED INVENTIONS

(Continued from page 626)

PICTURE FRAME.—T. E. JOPE, 507 W. 125th St., New York, N. Y. The invention provides means for preserving a picture from damage by fl.e or dust; prevents the removal of a picture from its frame; provides an indestructible frame; and provides automatic fire protection shutters operable by the heat of the surrounding atmosphere.

ACCOUNTING SHEET.—J. W. PENNEWILL, Silver City, New Mex. This improvement relates to sheets for carrying accounts and particularly to a journal sheet and has for an object the provision of an improved arrangement of ruling whereby it is possible to carry an entire monthly record on one page for a large number of distinct items.

PROCESS OF RENDERING TEXTILE FABRICS ANTIQUE.—M. V. ADOM, 297 5th Ave., New York, N. Y. The invention has reference particularly to the process for rendering tapestry antique, and more particularly oriental rugs. It provides an inexpensive, rapid and efficient process whereby newly manufactured textile fabrics can be rendered antique by reducing the brightness of the colors and giving a luster to the fabric.

BOTTLE HOLDER.—H. KENNELL, 1929 Armstrong Ave., New York, N. Y. This device is more especially designed for use on doors, is easily applied and arranged to enable the milkman to readily place one or more bottles of milk in position on the holder, to close and lock the same to prevent unauthorized persons from abstracting the bottle, and to allow the tenant of the house on opening the door to readily remove the bottle or bottles from the holder.

MASONRY BEAM.—W. P. FRANCIS, 83 Marietta St., Atlanta, Ga. This beam is of the metal reinforced type, and the invention improves the construction whereby the tiles on the bottom of the beam are more firmly anchored, and whereby the beam is materially strengthened, compared with prior structures.

COLLAPSIBLE TUBE FOR PASTE.—G. H. NEIDLINGER, 79 Murrary St., New York, N. Y. This invention has to deal more particularly with means whereby the external surface of the tube can be printed in a plurality of colors expeditiously, accurately and economically. By the means employed the output of the printing machine is many times increased over the old method of operation.

BIRD BATH HOUSE.—W. MACK, 2193 Broadway, New York, N. Y. This bird bath house is arranged for convenient attachment to a bird cage at the door opening to allow the bird to pass from the bird cage into the bath house to take a bath and then to return to the cage, the bath house being arranged to allow of conveniently filling and emptying the bath tub.

BACTERIA AND FUNGI EXTERMINATOR.—W. R. KLECKNER, care of Cowell Portland Cement Co., 2 Market St., via Bay Point, Cowell, Cal. This invention relates to bacteria and fungi exterminator intended for injection by inoculation into plants, particularly trees, shrubs and vines, for exterminating bacterial and fungicidal diseases. It provides effective agents for the extermination of bacteria and fungi.

CIGARETTE BOX WRAPPER.—G. E. LAMBERSON, 13 St. Andrews Place, Brooklyn, N. Y. This invention provides a box wrapper with matches and means for igniting the same when the matches are separated from the wrapper; and provides a wrapper separable from the box and adapted to be affixed thereto, said wrapper carrying a supply of matches with means for igniting the same during the operation of separating the matches from the wrapper.

Hardware and Tools

LOCK NUT.—C. C. VAN DER VALK HAGUE and F. M. VAN PANTHALEON BARON VAN ECK, Rotterdam, Netherlands. This invention provides a nut lock of very simple construction, cheap to manufacture, capable of ready application and efficient in preventing the removal or loosening of a nut from its bolt. It provides on one of the end faces of the nut a projecting marginal lug the outer surface of which preferably coincides with one or more sides of the nut, while its inner surface is curved, preferably to a cylindrical form, the axis of the cylindrical surface lying opposite the protecting lug, and being so located that the axis of the nut lies between it and the said lug.

SAW SET.—E. ABEL, St. Joseph, Mich. This invention permits of adjustment so that the amount of set may be regulated as desired. With this saw set the saw blade is always held in the same position in the saw set irrespective of the amount of set required, the desired amount of set being obtained by an adjustment of a fulcrum member, which adjustment may be quickly made.

FIRE HOSE COUPLING.—W. R. GOUGH, 46 Prospect Place, Brooklyn, N. Y. This improvement provides a coupling arranged to present to all outside appearances a cheap, ordinary, malleable iron coupling at the same time providing a coupling with interior, invisibly engaging threaded bushings of brass to prevent undue corrosion by the passage of water through the coupling.

NUT CRACKER.—W. J. PAYNE, Panther Burn, Miss. An object of this invention is the provision of a simple, inexpensive and efficient nut cracker with which nuts of various dimensions can be easily and quickly cracked without smashing the kernel but with which the shell of the nut is positively broken open.

CALIPERS.—R. L. MOSSMAN, Humboldt, Tenn. This invention relates to calipers of special construction, whereby it is possible to readily ascertain the minimum diameter of circular stock material from which pieces of even-sided polygonal

CALIPERS

cross-section can be made. It provides a caliper easy to use, and adaptable for special or ordinary use. The improvement on the calipers does not in any way interfere with its use as an ordinary inside caliper.

PUMP TOOL.—A. J. WOODWARD, 411 Lake Ave., Worthington, Minn. In the present patent the invention is an improvement in pump tools, and has for its object the provision of a tool especially adapted for use in conection with pump heads for removing short sections of threaded pipe broken off in the head.

BORING AND GRINDING TOOL.—C. H. SCHOLER, 2225 Harriet Ave., Minneapolis, Minn. This inventor provides equipoised bearings for grinding tools; supports an end-mounted grinding tool on bearings juxtaposed to the operating plane of said tool; and simplifies and reduces the cost of construction of tools of the character mentioned.

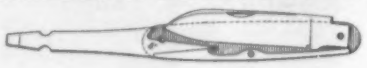
SAW ATTACHMENT.—A. C. BUTTMAN and F. P. GABLE. Address the latter, 601 E. 4th St., Muscatine, Iowa. This invention provides an attachment for use in connection with button saws and the like, for permitting the saw to be tightly keyed in the spindle, regardless of the length of the saw, and for reinforcing the jaw adjacent to the teeth, and for permitting the easy removal of the saw, wherein a stem is provided having an enlargement fitting within the saw and engaging within the adjacent end of the spindle, and having a locking sleeve for engaging within the upper end of the saw to key the saw in place.

CUTTER HEAD FOR SUCTION DREDGES.—J. W. SACKETT, 257 W. 5th St., Jacksonville, Fla. This invention has reference to cutter heads for suction dredges. An object thereof is to provide a simple and efficient head so shaped that a greater length of the cutting blade engages the material of the bottom at the average depth of dredging, to facilitate the drawing of the loose material into the suction pipe.

UNIVERSAL MICROMETER.—P. LACKNER, 3 Oxford St., New Brunswick, N. J. In this case the invention had reference to measuring instruments and particularly to a micrometer which is in the nature of a caliper, and has for an object the provision of an improved arrangement whereby any distance within wide limits may be accurately measured.

TOOL HOLDER.—A PEREZ DE VILLA-AMIL, San Fernando, 168, Cienfuegos, Cuba. A general object of the improvement is to provide a holder adapted to be connected to a support on a grindstone frame or the like, and having means for holding various tools, as well as means for variously adjusting the tool to properly present the same to the grindstone.

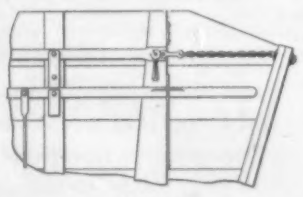
TOOL.—W. R. BROWN, Olean, N. Y. The invention provides a knife, the handle of which is adapted for use as a blade-holder, and provides a series of blades adapted for tempor-



TOOL

ary mounting on said handle; guides the blades when being applied to said handle; provides means for holding a blade in said handle; and provides means for readily disengaging a blade from said handle.

LATCH.—E. E. BOYUM, Pala Maui, Hawaii. The invention has particular application on railway cars, provided with drop sides or ends, such as are used on sugar plantations, and provides a latch employed in connection with a chain which will take the load from the wood-



LATCH

work of a car, which will carry the load on the brace bar and not on the latch, which will be held to position by gravity, which will not require snaps or tying with twine to keep the same in place, which will never turn the hand loose until manually operated to accomplish this result, and which will be easy to refasten.

PENCIL HOLDER.—G. W. PAULUS, Grand Rapids, Wis. The invention provides a holder and means for securing the same in convenient positions for instant use, as upon the back of tablets, upon school blank books, upon memorandum books, note-book covers, etc., and in some forms may be used on the flat portions of covers, on desks, on a wall, or any other convenient and suitable place.

Heating and Lighting

PORTABLE ELECTRIC LAMP.—L. F. JAMES and R. F. JAMES, 907 Broadway, New York, N. Y. In this case the invention relates to electric lamps of the hand or self-contained type, and one of the main objects thereof is the provision of a casing for such lamps which will be waterproof, the present embodiment insuring this result by the elimination of push-button switches at present employed in these lamps.

LAMP CHANGING DEVICE.—A. ZEISEL, care of Zeisel Electric Co., Bel Air, Md. This invention relates more especially to those devices which are used to change incandescent light globes. It provides a device which will firmly grasp the socket and which may be instantly released from the latter. It provides means for positively locking the gripping device in position, thereby obviating the danger of dropping the globe and socket through the retraction of the gripping arm.

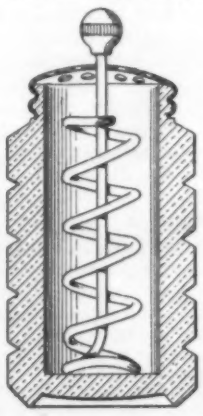
ILLUMINATING DEVICE FOR ELECTRIC FIXTURES.—R. E. HOUGHTON And M. J. HANLON, Cliftondale, Mass. The invention is more particularly intended for embodiment in a pendant attachable to a pull-chain or the like. The prime objects are to obtain the maximum illumination from the luminous material and to produce an effective luminosity from a minimum quantity of luminous material, whereby high grade and expensive material may be employed without unduly increasing the cost of manufacture.

BURNER FOR DENTAL FURNACES.—C. H. LAND, 64 W. Elizabeth St., Detroit, Mich. The inventor provides a furnace in which extremely high temperature may be had by the use of ordinary illuminating gas, producer-gas, etc., which are ordinarily not considered capable of being used successfully owing to the fact that it is extremely difficult to prevent the ignition of the charge in the mixing chamber, thereby causing an explosion.

Household Utilities

AUTOMATIC COAL FEEDER.—F. S. SEYMOUR, 2123 Sinton Ave., Walnut Hills, Cincinnati, Ohio. Mr. Seymour provides a feeder particularly adapted for feeding coal to small heating stoves, ranges, furnaces, house boilers, tank heaters, feed cookers, and the like, in which there is not a very large consumption of coal. The action of the automatic feed may be so regulated so that the period of operation will extend over any desired number of hours.

SALT SHAKER PULVERIZER.—F. E. TEVES, 505 Spruce St., Richmond Hill, L. I., N. Y. Among the principal objects which the present invention has in view are: To provide a utensil of the character mentioned with a device



SALT SHAKER PULVERIZER

for pulverizing and delivering the contents of said utensil; to provide a device simple in form and at a reduced cost, and to provide a device the operation whereof is thorough and searching.

EXPANSION FASTENING FOR CASTERS.—J. W. HILFRANK, 1 Mamaroneck Place, White Plains, N. Y. This improvement provides a fastening for fastening casters to bedposts, and other articles to walls and the like, which fastening is arranged to securely hold the fastening in place, to allow the article to swing freely on the fastening after the latter is secured in position, and to permit convenient removal of the fastening whenever it is desired to do so.

GARBAGE RECEPTACLE AND TRAP.—C. W. HARTT, Pierson, Mich. This invention relates to garbage receptacles and has for an object to provide an improved construction wherein the garbage can is maintained out of sight and means are provided which will entrap a mouse, rat or similar animal without allowing the animal to enter the can.

WINDOW SCREEN.—M. W. CHARLTON, 1074 Lafayette Boulevard, E., Detroit, Mich. The invention relates to window screens, and has reference more particularly to self-winding screens adapted to automatically obstruct any opening made by moving the window sashes and thereby preventing flies from entering through the openings formed by moving the sashes.

MOSQUITO BAR.—V. A. SMITH, Charleston, Miss. In the present patent the invention has reference to a mosquito bar, and the object thereof is the provision of a collapsible bar which can be secured to the frame of a bed so that it may be easily and quickly placed into operative or into inoperative position.

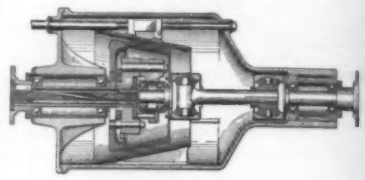
COVER FOR REFUSE CANS.—A. F. LUYTIES, Sharon Springs, N. Y. The improvement provides a cover arranged to permit the user to readily deposit the refuse into the can without danger of the odors arising from the refuse held in the can passing into the kitchen or other room in which the refuse can is located at the time, and to allow the garbage collector to readily empty the can.

INVALID CARRIER.—W. C. OGDEN, 44 Commerical Ave., Binghamton, N. Y. The carrier is for use in connection with a bedstead, whereby the patient may be raised, lowered or placed in different angles or positions above the bed for the purpose of resting and other benefits, changing the bed clothes and also for the purpose of changing the position of the body and limbs for certain treatments, and with the least possible annoyance or injury to the invalid.

Machines and Mechanical Devices

MACHINE FOR CUTTING CINEMATOGRAPHIC STENCILS.—M. VANDAL, 12 Rue Gaillon, Paris, France. This invention relates to a machine for cutting films for the purpose of making stencils suitable for the mechanical coloring of other films designed to be projected in colors. The present machine is so fitted that the cutting tool will be positioned to cut out an image of the film at the same time that the source of light is projecting the following image on to the translucent glass.

CHANGE SPEED DEVICE.—J. W. T. GUTT, 87 Eppirt St., E. Orange, N. J. This invention relates to a change speed device of that type embodying a crank pin connection between the driving and driven shaft, which crank pin can be



CHANGE SPEED DEVICE

changed from a concentric to an eccentric position, or *vice versa*, for the purpose of producing a gradual change in speed or power from zero to maximum, or the reverse, for insuring smooth running, highest efficiency and long life of the mechanism.

MACHINE FOR CONVERTING PULP INTO SHEETS.—H. G. ROGERS, Au Sable Forks, N. Y. In this invention Mr. Rogers produces weakened lines by means of a groove in one of the final pair of squeezing rollers, whereby the grooved portion of the roller will leave the sheet wet along the line of the groove, thereby causing the sheet to readily part at this line in response to the higher speed of the breaking rollers. The invention comprises also a washing means for one of the aprons forming part of the machine.

SCUTTLE HOLE PROTECTOR.—A. GAZENMÜLLER, 12 Overlook St., Mount Vernon, N. Y. The object here is to provide a scuttle hole protector having a locking device which is very simple and durable in construction and arranged to securely lock the protector in place and against opening from the outside by a burglar or other person.

ELEVATOR.—T. P. FORD, 47 Breevoort Pl., Brooklyn, N. Y. This invention provides certain improvements in elevators, arranged to prevent the operator of the car from starting the latter after stopping at anyone of the landings unless both the shaft door and the car door are in closed position, thus insuring safety to the passengers going in and out of the car.

FLEXIBLE COUPLING.—W. J. FRANKE, New Brunswick, N. J. The purpose in this case is to provide a flexible coupling arranged to insure proper transmission of the power from one shaft to another even should such coupled shafts be out of line or out of center, to combine strength with flexibility and to reduce the cost of manufacture to a minimum.

INTERMITTENT MOVEMENT MECHANISM.—J. F. DAVIDSON, Duncan, Okla. The inventor provides an intermittent movement which is applicable to moving picture machines and by means of which the intermittent movement of a film is accomplished in such a manner that there is very little liability of injuring the film, while at the same time rendering the device easy of manipulation and practically noiseless.

CIGARETTE MAKING MACHINE.—P. HAYN, 1706 Gates Ave., Brooklyn, N. Y. The invention relates to individual cigarette making machines adapted to be carried in the pocket of the owner and ready for instant use, which is of very compact form and is made to present the general appearance of a cigarette box of the shallow, one layer, type.

KNIFE SETTING GAGE.—F. J. WUESTHOFF, 815 Aileen St., Oakland, Cal. The present invention relates particularly to a gage for use in setting the knives of cutter heads used in wood working machinery of various types, which heads are, as well known, from one to thirty-six inches in length and hold from two to eight knives.

BUTTON AND BUTTONHOLE MARKER COMBINED.—J. A. GORMAN, 21 Ryerson Ave., Newton, N. J. In this instance the invention relates to shoe marking machinery and particularly to an arrangement for locating the buttons and buttonholes, and has for an object the provision of an arrangement whereby the quarters of a shoe may be marked both for the buttons and buttonholes.

(Continued on page 630)

How the Austrians Make Paper Twine, Yarn and Belting

TO meet the situation due to a curtailed supply of hemp, jute and flax, paper has been substituted in the Austrian market as a principal constituent of twine, cordage and yarn. The shortage of leather also has practically resulted in the production of exclusively paper belting for industrial purposes.

The manufacture of paper cordage, yarn, twine and belting has developed considerably within the past few years. Some persons have raised the question whether these paper products will not permanently supplant others even after the war. Practical results observed since the wholesale introduction and use of paper twine took place, lead to the conclusion, however, that it is improbable paper-made products of this nature will, under ordinary and normal conditions, eliminate and replace hemp-made twine. There are similar doubts as to yarn and belting.

Paper twine has the advantage of a low cost of production, but actual practice shows that the paper-made product, although seemingly possessed of all the necessary qualities of hemp twine, falls slightly short of some of the physical requirements demanded of it.

Wood pulp is the source of supply of the raw material in the paper cord, yarn and belting industry, and ordinary paper made from wood pulp, cut into reels, is the foundation of the whole industry. The reels of paper are run by means of spinning machines through a paraffin bath and then into strands and twisted into cordage or twine. All that then remains is to pack the product into the desired forms—in bales or balls. It is said that only one operator is necessary for each machine in the spinning process, and in the present practice the operator is usually a girl.

Pulp obtained from either pine or fir trees is considered most satisfactory for this industry. By means of coloring processes the twine is made in any color that may be desired. The product found on the market here resembles hemp twine in color and appearance.

The paper cordage, twine, yarn and belting sold in Fiume are not of local manufacture, but are obtained from other parts of Austria-Hungary, chiefly from Bohemia and northern Hungary. A project is on foot to start a factory in Fiume, or in nearby Croatia, for the manufacture of these paper products, but it has met with little success so far. The Bohemian and Hungarian industry seems to be able to produce enough paper cordage, yarn and belting to supply the local demand.

On the market in Fiume paper cordage and twine are packed in either bales or balls and are sold according to weight or length, usually according to weight.

Physical tests for tension and moisture to which the paper-made products have been subjected are met more satisfactorily by products of hemp or jute. Paper cordage and belting, when moist, lose practically all the properties of tensile strength so essential to their use, and when thoroughly wet fail to resist even slight tension. Paper cord for use in wrapping packages or bundles in retail business, however, is admirably adapted for such purposes and possesses practically every quality desired.

In order to increase the tensile strength of paper cordage, etc., hemp or wire is often used as an adjunct with the paper in the process of manufacture, a thread of hemp or metal wire forming an inside or outside filament, as may be desired. The price of cordage containing the wire or thread of hemp is naturally higher than that of ordinary paper twine.

The process of impregnation of paper cordage with paraffin is carried out in two different ways, according to the quality of the cord; that is, whether it contains the wire or hemp filament or not. If the twine is of paper only, the spool of paper which runs from the bobbin to the spinning machine is passed through a small canal in which there is liquid paraffin, which melts at a comparatively low degree of temperature. If the cord contains a wire filament or a strand of hemp, the paper cord alone must first pass through the paraffin bath in the process of manufacture, and after cooling it is passed through a small canal again, but this time together with the metal or hemp filament. The paraffin now used is a low-grade artificial product, which is employed because of the scarcity of the by-products of petroleum.

Paper belting as well as paper cordage is used in the Fiume district at present. The resistance of paper belting to traction is quoted by local firms as varying from 10 to 100 kilos (22 to 220 pounds) according to quality. The belting is of matlike texture woven with the ordinary paper cord, and may be strengthened by various processes according to the quality of the cord and also to the weaving texture. It does not attain the strength of leather belting and the abrasion on the paper cord is so much greater than on leather as to diminish its durability considerably.

Considering the present size of the industry, and the extent to which it has been stimulated by the demands it has had to meet, it is probable that in the process of evolution, certain improvements may be attained in the manufacture of these paper products which would make it a permanent fixture of some importance. Large amounts of capital have been invested, and the paper products may become articles of export at the close of the war. The supply of wood pulp is said to be sufficient for the requirements of the twine, yarn and belting industry.

Paper of Mercerized Cotton

IF cotton be treated under certain conditions with a strong soda lye, then the so-called "mercerized cotton" is produced which is especially characterized by its silky sheen. As enormous quantities of mercerized cotton are now-a-days worked up by the textile industry, it will hardly come as a surprise to learn that considerable quantities of such cotton are repeatedly found among the rags sold to paper factories.

The action of this in the paper making processes is, of course, different from that of ordinary rags. In order to determine these differences cotton tissues, consisting of more than half mercerized cotton, were sent through the paper mill as an experiment, the other half of the material used being made of ordinary cotton as usual. Both halves were worked up into paper in the same way; the samples secured were next tested for tenacity, absorbent power and breaking strain. The tenacity of the paper made from mercerized cotton was inferior but its absorbent powers were much higher; the breaking strain of both was the same. The experiments clearly showed that rags of mercerized cotton were peculiarly suitable for the manufacture of blotting paper.

Why Hot Water Pipes Freeze More Quickly than Cold

IT is a constant observation that during a sudden cold snap hot water pipes burst, while the cold water usually freezes up tight without rupture of the pipes carrying it. A French experimeter has recently looked into the cause of this. He finds that the hot water invariably falls to several degrees below zero Centigrade before beginning to solidify, and that the ice then formed is perfectly solid and transparent. Ordinary cold water, on the other hand, begins to congeal as soon as the "freezing point" is reached; this ice is filled with air bubbles, and presents a soft and mushy appearance.

The explanation is that the air and other impurities in ordinary water furnish nuclei of crystallization. Ice formation thus begins sooner and proceeds more slowly than if these were absent; and the ice formed is more mobile, so that pressures are not so severe. Hot water, however, is to a large extent free of gas particles, which have passed off during the process of heating, so this effect is not observed. Freezing does not take place gradually, but all at once, with somewhat of an explosive effect; and there is no cushion of gas bubbles to take up the shock. That this explanation is correct is indicated by the fact that when a current of air is forced through the hot water just before freezing, it behaves in every detail just like cold.

RECENTLY PATENTED INVENTIONS

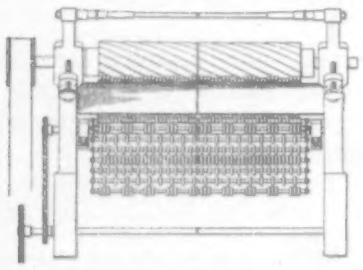
(Continued from page 628)

OPERATING MEANS FOR ELEVATOR SHAFT AND CAR DOORS.—J. E. W. FOGAL, Quincy, Ill. A specific object of the invention is the provision of an electromechanical apparatus for opening and closing elevator or hatch doors according to the will of the operator, the apparatus including means whereby the power for moving the car is cut off as long as the gate or door is open, so that the operator must see to the closing of the door before starting the car.

AUTOMATIC TOOL SHARPENING BUTTON LATHE.—P. F. DUSHA and A. FEYK, 1797 First Ave., New York, N. Y. This invention provides a turret for carrying a plurality of tools in combination with one or more grinding devices so related to the tools that by the movement of the turret to and from the button check, one or more of the tools will be automatically sharpened while another tool is employed for cutting a button blank.

KEY CUTTING MACHINE.—F. WANKEL, 1862 Linden St., Brooklyn, N. Y. The improvement pertains to metal-working machinery and has particular reference to machines for cutting duplicate keys. It provides a machine for the cutting of lock keys of the type commonly known as Yale, Corbin or similar keys in which notches, grooves or slots of varied lengths or widths are provided

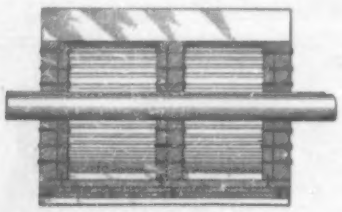
ATTACHMENT FOR CUTTING FIGURES ON FABRICS.—M. E. DRISCOLL, 134 W. End Ave., Somerville, N. J. The invention refers to the manufacture and finishing of fabrics and has particular reference to the treatment of pile



ATTACHMENT FOR CUTTING FIGURES ON FABRICS

fabrics such as carpets, plushes, felts, shawls or any other fabric, the pile of which is to be trimmed, cut or shorn. It provides an attachment for a fabric shear whereby the cutting or shearing of the pile may be performed according to any design or regular configuration.

BEATER ROLL.—J. A. MUIR, 49 Elm St., Morristown, N. J. This invention relates to paper pulp engines, and similar machines, and provides a beater roll, which is simple and durable in construction and arranged to securely hold the blades in position and against bending, to permit convenient and quick replacing of a broken or

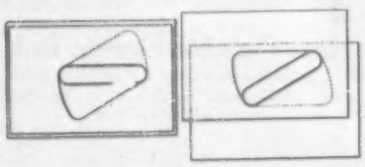


BEATER ROLL

otherwise injured blade by a new one, and to allow use of the blades until practically worn out down to the peripheral faces of the heads.

DUMPING DEVICE.—C. E. HILTON, Box 35, Monarch, Wyo. The improvement is in dumping devices for weigh baskets, hoppers and the like, and provides mechanism for firmly locking the counterweighted discharging door of the hopper or weigh basket in open or closed position, and wherein manually operated means is provided for releasing the door in either position.

MECHANICAL MOVEMENT.—R. F. SEGERBERG, Box 506, New Britain, Conn. This invention relates to a mechanical movement particularly adaptable for coupling and uncoupling machine elements; and it is characterized by



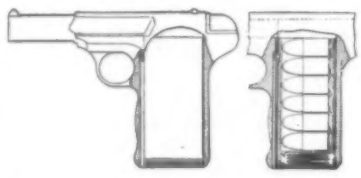
MECHANICAL MOVEMENT

the provision of a pair of relatively movable members each having recesses in which a key floats, said key being adapted to limit or predetermine the relative movement of the movable members and lock them to one another at the limits of their movement.

GATE VALVE.—R. J. RILEY, Livermore Falls, Maine. The invention refers to gate valves of low pressure, mainly used for controlling the flow of semi-fluid substances. It provides a gate valve which is provided with a removable seat for the gate. It also provides a valve in which the worn out seat can be easily and quickly replaced.

TRANSMISSION GEARING FOR MOWING MACHINES.—L. BRADEN, Carbon, Cal. The invention provides a gearing for mowing machines in which there are two driving connections with the pitman shaft, these connections engaging opposite sides of the shaft so that their thrust is in opposite directions, the thrust of one counterbalancing the thrust of the other, so as to eliminate as far as possible, the friction in the bearings of the driven end of the pitman shafts. Mr. Braden has invented another transmission gearing in which there are two driving connections with the pitman shaft, these engaging opposite sides of the shaft so that their thrust is in opposite directions, the thrust of one conterbalancing the thrust of the other, so as to eliminate as far as possible, the friction in the bearings of the driven end of the pitman shaft. The same inventor has invented a third tansmission gearing the construction of which permits the pitman shaft to be placed in a position more nearly approximating the horizontal than is possible with the transmission gearings now in use, and to thus do away with the greater part of what is known as "wringing" motion of the pitman common to all machines in which the rear end of the pitman shaft is of necessity much higher than the crank or forward end.

CARTRIDGE MAGAZINE.—L. W. HILGENDORF, Fountain, Colo. In this instance the invention has reference to firearms, of the repeater type, and the main object thereof is to double the magazine capacity and to provide



CARTRIDGE MAGAZINE

simple though efficient means for instantly and automatically throwing an exhausted portion of the magazine out of operative position and moving the unused stock of cartridges into operative position.

PLASTER BLOCK MAKING MACHINE.—D. F. BERNHARDT, 26 York Terrace, New Brighton, S. I., N. Y. The invention relates to the art of making plaster blocks for building purposes, and more particularly blocks of that type provided with air ducts or cells. It improves the process of block-making so as to be more economical, expeditious and simple than methods heretofore employed.

APPARATUS FOR MAKING RUBBER STAMPS.—R. WILDAY, care of Barton Mfg. Co., 87 Duane St., New York, N. Y. According to the usual method of making rubber stamps the impression of the type composition is made on a plastic material which requires about two hours to dry or harden so as to form a mold by which the rubber type or stamp is made. This invention provides mechanical means for carrying out the process, it requiring only about ten minutes to make a complete rubber stamp.

MARBLE MACHINE.—G. J. COOK, General Delivery, Fairmount, W. Va. This inventor provides a machine having a plate with a spiral groove in its face, and a roller disposed at the face of the plate, the roller having a spiral groove, which with the spiral groove in the plate forms circular openings, the roller and plate being rotated to move the roller and plate in opposite directions at neighboring points, this movement of the plate and roller serving to roll the material into spheres forming the marbles.

Medical Devices

SURGICAL INSTRUMENT.—M. B. HERMAN, 1132 Jefferson Ave., Memphis, Tenn. The improvement pertains more particularly to an instrument for diagnosing certain internal troubles, and provides a practical instrument for detecting stones in the bladder, pelves of the

SURGICAL INSTRUMENTS

kidneys, etc. It provides a sound box, together with means in connection therewith and adapted for introduction into the bladder, pelves of the kidneys, etc. whereby upon contact with a stone, the sound of such contact will be communicated to the sound box.

Musical Devices

UNIVERSAL TONE ARM.—P. BECKER 102 W. 109th St., New York, N. Y. The invention relates to phonograph tone arms of that type which adjustably supports the reproducer so that the phonograph can play hill-and-dale and lateral cut records. It improves the construction and operation of devices of this character so that the needle will travel approximately in the same line on either type of record, whereby a better reproduction of sounds will be obtained and there will be less wear and tear on the sound grooves

ATTACHMENT FOR PHONOGRAPHS.—F. L. BARROWS, Moscow, Idaho. This attachment is capable of connection with a phonograph of ordinary type and operated by the motor of the phonograph for permitting a series of records to be played in succession, wherein mechanism is provided for lifting the reproducer arm at the end of each selection, and moving it to the place of beginning, and wherein other mechanism is provided for removing the uppermost record while the arm is lifted. Mr. Barrows has invented another attachment which is capable of connection with a phonograph of ordinary type and operated by the motor of a phonograph for permitting a series of records to be played in succession, wherein mechanism is provided for removing the topmost record from the turn table when it has been played, and wherein other mechanism is provided for gradually lifting the turn table as the records are removed, to bring the uppermost record into proper playing position.

STOP FOR PHONOGRAPHS.—W. E. CLEVELAND, Fall River, Mass. The improvement relates to phonographs of the disk record type, and provides an automatic stop arranged to automatically stop the phonograph at the time the stylus reaches the end of the record, and to allow quick and convenient adjustment of the automatic stop for larger and smaller records.

AUTOMATIC STOP FOR PHONOGRAPHS.—J. E. SOONS. Address Edward Caterson, 17 Battery Place, New York, N. Y. This automatic stop is truly automatic in its nature, and requires no adjustment or other attention on the part of the operator either for starting or stopping the operation of the disk. It is operative to stop the turntable either when the end of the record is reached or when the reproducer at any time is thrown over into its inoperative position irrespective of the position of the record that may have been rendered.

REPEATER FOR TALKING MACHINES.—W. L. LIGHTFOOT, 1377 E. 17th St., Brooklyn, N. Y. This contrivance can be attached to a Victor without any change or displacement of any part of the machine. The invention provides a device which can be easily and quickly put into operative or into inoperative position, and which, when secured to the machine, in no way interferes with the ordinary playing of records.

ZITHER ACTION.—F. MENZENHAUER, 22 Sherman Place, Jersey City, N. J. This invention relates to zithers and similar instruments provided with separate sets of melody and accompaniment strings. It provides a zither action more especially designed for playing with the left hand the accompaniment strings in a very simple, effective and accurate manner and with the desired gradation in the tone.

RECORD CABINET.—A. M. BREXENDORF, Carlisle, Pa. This invention refers to a cabinet for holding the disk records of talking machines and in which the records are held in a plurality of vertical series, the holder being mounted to turn on a vertical axis to bring any particular series of records to the front of the cabinet.

PEDAL GATE FOR PIANOS.—T. W. VRANA, 310 21st St., Irvington, N. J. The invention relates to means for preventing mice from entering a piano through the openings provided for the displacement of pedals. It provides a gate which will normally close the pedal opening in the piano without in any way interfering with the operation of the pedal.

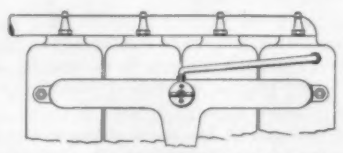
Prime Movers and Their Accessories

CARBURETER.—H. C. MERRIAM, care of Joseph R. Morgan, 305 Lombard Bldg., Indianapolis, Ind. One of the principal objects in this case is to effect a maximum saving in fuel by causing the same to be broken up as it emerges from a nozzle, and to insure a thorough saturation of air at all engine speeds through the manner of introducing the air around a nozzle.

CONNECTING ROD BEARING.—H. J. SHELDRUP and O. O. MALAND, Pelican Rapids, Minn. The invention relates generally to connecting rods utilized to connect the movable pistons and the crank shafts of internal combustion engines, and more particularly to the bearings thereof upon the crank shafts, and provides a bearing whereby to maintain the bearing surfaces of the connecting rod and crank and offset the wear, and to eliminate undue and uneven wear.

ROTARY ENGINE.—A. WATTERBERG, Sanish, N. D. An object of the invention is to provide a reversible engine which is simple and efficient, which comprises a plurality of radially-disposed cylinders revolubly mounted about a fixed axis with means for actuating the pistons within the cylinders during the revolution of the cylinders. Another object of the invention is to provide a casing which encloses the entire engine and which also serves as a lubricant container in which the engine works.

AUTOMATIC ATOMIZER FOR INTERNAL COMBUSTION ENGINES.—E. WALDMEIER, Cor. 27th Ave., and 14th St., Gulfport Miss. The invention provides a device by means of which the water from the water jacket

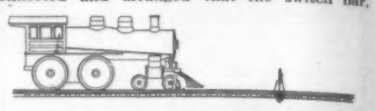


AUTOMATIC ATOMIZER FOR INTERNAL COMBUSTION ENGINES

of the engine may be automatically drawn into the intake manifold of an internal combustion engine, thereby mixing with the fuel and air, to cool the engine and to reduce the deposit of carbon in the cylinders.

Railways and Their Accessories

RAILWAY SWITCH.—F. EVANS and D. DUTT. Address Burtis O. Markham, Box 28, Riverdale, Mich. This invention relates particularly to a switch and signal of the type adapted to be actuated by a train trip, and is so connected and arranged that the switch bar,



RAILWAY SWITCH

connected with the switch points, will be rocked by a train trip and a sliding axial movement will be given to the switch bar, the rocking movement serving to actuate a semaphore while the sliding movement serves to throw the switch points, the operation being automatically effected by a train coming from either direction at any rate of speed.

AXLE LUBRICATOR.—T. O. ORGAN, Care of Keystone Lubricating Co., Philadelphia, Pa. This invention, while capable of application generally to running wheels and their axles, is more particularly intended for embodiment in car wheels. The invention relates to a means whereby to lubricate running wheels turning on a stationary axle and having a reservoir for the lubricant surrounding the hub and bore of the wheel.

RAILWAY TIE AND FASTENER.—J. G. SNYDER, 620 W. 116th St., New York, N. Y. The invention has reference to railway ties and fastening means therefor, and has for an object the provision of an improved simplified structure whereby a strong tie is produced and simple strong fastening means are associated therewith for holding rails in place on the ties.

CONCRETE RAILWAY TIE.—L. DUNCAN, Box 985 Butte, Mont. The invention has particular reference to cross ties for railway rails, and it provides an improved form or type of ties, the same being of composite nature, the body portion of which is concrete suitably reinforced, but with special provision for attachment of the rails thereto.

CAR SAFETY FENDER.—A. LEIBNER 2520 8th Ave., New York, N. Y. The improvement relates to safety devices and particularly to carfenders, and has for an object the provision of an improved fender especially adapted for street cars which is normally moved to raised position out of the way but which may be quickly lowered in case of an accident.

Pertaining to Recreation

NURSERY RATTLE AND TOY.—H. E. MATHIAS, care of William Kaufman, 7 Beekman St., New York, N. Y. The invention has for its object the provision of a rattle which includes a toy in the form of a figure or freely movable object which moves about in the use of the rattle, and the motions contribute greatly to the amusement of the infant.

AUTOMATIC PIN SETTER.—E. SCHLOSSBERG, 1009 Metropolitan Ave., Brooklyn, N. Y. This improvement relates to ten-pins games, and an object thereof is to provide a mechanism for automatically resetting the pins. A further object of the inventor is to provide an apparatus whereby the use of the pin boy may be dispensed with.

ANGLE SPREADER AND SWIVEL.—H. A. SCHILLING, 1722 Harmon St., Brooklyn, N. Y. Among the principal objects which the improvement has in view are: to exert a straight line pull on the lure and parts of the spreader and

ANGLE SPREADER AND SWIVEL

swivel under all service conditions; to avoid entangling the fishing tackle; to avoid stresses on the parts of the tackle transverse thereto; and to secure the desired service arrangement of the parts of the tackle at the completion of a cast.

GOVERNING DEVICE FOR TAKE-UP REELS OF MOVING PICTURE MACHINES.—A. D. COVERT, 209-211 Adams Ave., E., Detroit, Mich., Route 2. An object of this invention is to provide a device, by means of which the take-up reel will be increased in speed as the film is fed faster through the machine up to a certain point, after which the take-up reel will maintain a uniform speed, thereby obviating the danger of excessive speed which will tend to strain or break the film.

COLORING MACHINE FOR MOVING PICTURE FILMS.—M. VANDAL, 8 Rue Saint-Angustin, Paris, France. The invention relates to a machine for films in which the color is applied in a well known manner, by means of brushes and of openings in a positive film, the contours of such openings corresponding with those of the parts to be colored. The invention does away entirely with handwork in the application of the color, of giving great regularity to the coloring, and of turning out a great deal of work.

TOY.—W. E. CRESSMAN, Gwyneed Valley, Pa. This inventor provides a toy picture machine provided with a source of light on the rear of the screen, and a platform adapted to be turned and provided with means to receive paper

(Concluded on page 632)

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(14224) E. D. B. asks: I have read your magazine for some time and am always interested in any form of radio work. I have operated a small set here for two years and have done some experimenting in an amateur way. A peculiar incident happened me to-day as I was walking in from the country. I noticed a droning sound which broke intermittently, coming from a telephone pole, and the regularity of the sounds drew my attention immediately. They seemed to be coming from a loose insulator and the buzzing sound was audible at least twenty feet from the pole. You can imagine my surprise to hear the familiar attention call of the continental code and a message follow as plainly as from a reproducing horn. I was so excited that I hurried into town and called up the amateur stations but none had been working that hour. The closest station of any size is some fifty miles away. I can not understand how the minute amount of current which could have collected on the telephone line could have been transformed into motion in causing the insulator to vibrate. Have you ever heard of any similar experience? Certainly, I never have. At any rate I am writing you in the hopes that you can help me explain it. A. We have never met with the reception of wireless signals upon a telephone line, such as you describe; but we have heard them from an arc lamp, as probably many others have. We have no explanation to offer since we do not know the conditions under which the sounds which you heard were produced. Some of our readers may have had a similar experience and be able to give the explanation

(14225) L. B. T. asks: Would you kindly tell me if a ship sinking in mid-ocean at the deepest parts, goes to the bottom? A. An iron ship if it fills with water will sink to the bottom in any part of the ocean. We do not know why there is so much uncertainty on this point. The pressure of the water will not prevent sinking through it any more than the pressure of the air will prevent our falling through it. At any point under water the pressure is equal in all directions and does not affect motion through it. Divers walk about under great pressure of water, and go down or come up without difficulty. So, too, anything heavier than water sinks through it to the bottom.

(14226) W. H. L. asks: Would you kindly give me a formula for a good soap bubble solution. I understand that for scientific purposes they have a special soap bubble solution. I would greatly appreciate your kindness in obtaining the formula. A. A good soap bubble solution is made from 4 oz. white Castile soap, cut into shavings and placed in a quart of water. A two-quart bottle should be used and the mixture should be shaken several times till the solution is saturated. If it settles out clear use the solution; if it is not clear pour it off and prepare another with a quart of fresh water on the same shavings. The second trial will probably produce a clear solution. To a quantity of the solution add half as much pure glycerine, and shake together. This formula is from our Cyclopedia of Formulas which we will send for $5.

(14227) R. J. B. asks: 1. Suppose two springs composed of the same metal and of same weight were taken; one of them wound and the other sprung. Now an equal amount of sulphuric acid is put in each of two beakers, and one of the springs put in each beaker. Which will develop more heat? If same amount of heat is liberated, what becomes of potential energy in wound spring? 2. A thermometer was taken and its freezing point determined, which was found to be .5° C. The boiling-point was then determined and found to be 99.8° C. The freezing-point was again determined and found to be .2° C. Explain. A. 1. The Question of the coiled spring dissolved in an acid has come up again. We have not had it for several years. We give the explanation of Mr. Steinmetz, who says the coiled spring developes more heat in solution than the uncoiled. It appeared in the SCIENTIFIC AMERICAN Vol. 102, No. 15. The paper is now out of print. "The heat produced by the chemical action in a coiled spring, when dissolved, is greater by the amount of energy stored in it than if the spring were not under pressure. The amount of energy which is stored in compressing the spring in heat measure is so insignificant compared with the energy of solution that one cannot measure the difference calorimetrically, but one can prove that the compressed spring produces a greater heat in dissolving than the uncompressed spring, in an indirect manner. The measure of the chemical energy is the electrical potential difference. If one dissolves iron in an acid and the iron is under strain, partly compressed, partly not, one finds an unequal corrosion due to local current between the different parts of the iron. If there is a local current it means that the different parts of iron have different potential differences against the electrolyte, that is, different chemical affinities, and the part under strain is dissolved first, showing a greater potential difference and thus a greater heat produced in its solution. Thus, if only a part of the spring were compressed, the other part not, the compressed part would dissolve first in the sulphuric acid by the local current circulating between the two, showing that its solution gives more energy than that of the uncompressed part." 2. The expansion of the glass of a thermometer in determining its boiling-point is not quickly overcome by cooling it again. It contracts slowly for some time after it is heated. For this reason its zero error after being heated is less than before heating it. The bulb was slightly larger after heating. Glass is a very peculiar substance. It is classed as a colloidal solution.

(14228) O. K. C. asks: 1. In SCIENTIFIC AMERICAN of February 17th, Question No. 14197 was a great disappointment to me as during that week I had occasion to have two holes drilled in glass to repair a static machine. The trial was a failure. I am not K. J. C. and am writing to find out how to do the stunt successfully. 2. While writing there comes to my mind another puzzle. In demonstrating the polarity of dry cells by electroscope I found much greater divergence of leaves by connecting the zn. side to the lower plate than by the reverse. Was this a freak or a constant result? I can find no explanation in reference books at hand. Why did it act unequally? A. 1. The usual process for drilling glass is to make a solution of camphor in turpentine and add ether. Good proportions are camphor, 1 oz.; turpentine, 1½ oz. and ether ½ oz. Break the tip off a file and use the sharp corner of the file as a tool, wetting it frequently with the solution. Turn the file back and forth, not all one way. The file will bore the glass very easily. When the hole is opened through the glass it may be enlarged to any size by the use of a rat tail file and later by a half round file. Some care is necessary when the hole breaks through the glass, to use less pressure so as not to crack the plate. Care, patience and experience are the requisites for success. You will have need for all of these before you get a good round hole of any considerable size. 2. We have tried to repeat your experiment with the electroscope and a battery, both one of dry cells and a storage battery. We are, however, not been able to obtain any difference in divergence of the leaves by connecting the positive or the negative pole to the lower plate. Nor do we know any reason why there should be a difference.

(14229) G. E. O. asks: Will you please answer the following question for me: Would an object, say an iron ball, dropped from an aeroplane, ever attain sufficient velocity simply in falling, to become invisible? If so, how far would it have to fall in order to attain such speed? A. Whether a moving body would be invisible depends upon the direction of its motion with reference to the person who is viewing it. If a cannon ball is coming directly toward or going directly from one it would be visible, even if going at a very high velocity. If it is moving at right angles to the line of sight, it will be invisible if moving with a much lower velocity, how low will depend upon its size and its distance. It must fill an angle of at least a minute in order to be visible. We are not able to give a catagorical answer to your second question. We should answer the first question in the affirmative, it is possible.

(14230) A. M. L. asks: Does the Gulf Stream modify the climate of England in any way, or is it true that scientists have recently concluded that the Gulf Stream does not exist farther north than a point near Cuba? Why is the climate of England so much more temperate than that of Labrador? A. The Gulf Stream as a current of water in the ocean does not extend much beyond the Banks of Newfoundland, but the west winds of the Atlantic carry a drift of warm water to the Coast of Europe and this has received the somewhat awkward name of the "North Atlantic West Wind Drift." Since the warmth of this drift of water is due largely to the warm waters of the Gulf Stream it would not seem a great stretch of the fact to call it by its old name. You will find an interesting chapter on this matter in Tarr's College Physiography, which we will send for $3.75, postpaid.

(14231) G. E. T.: Our little town is considering the purchase of electric current from an interurban railroad company. They propose to furnish their regular power current which is twenty-five cycle alternating. Our present requirements of current are practically all for lighting service and we are using sixty cycle current. Will the twenty-five cycle current be satisfactory for lighting work? What are the drawbacks of such current for such purpose? Why does sixty-cycle current seem to be standard for lighting and twenty-five for power? Any suggestions that you might make as to the advisability of trying to use such current would be welcomed. A. The lower cycles are used on motors and the like and the higher on incandescent lamps. The reason is that the lamps could be seen to flicker with the lower cycles, and the variation in the light would be unpleasant or injurious to the eye. Sixty cycles are beyond the ability of the eye to distinguish. A light with that number appears constant.

(14232) G. R. H. asks: Will you kindly inform me through your queries column as to the best means of keeping a gravity or crow-foot cell while not in use. What can I use to let a small current be constantly flowing. A. You can use a length of iron wire strung on some sort of frame so that the parts shall not touch each other, for a resistance to your gravity cell, 100 feet of No. 24 will be sufficient. This will have a resistance of about 12 ohms and will allow about 1/12 ampere to flow, which should be enough to keep the cell in good condition.

RECENTLY PATENTED INVENTIONS

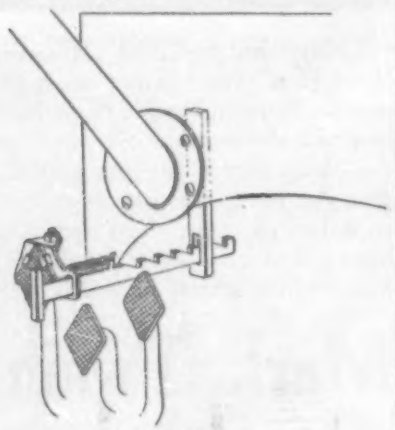
(Concluded from page 630)

dolls, cut-out pictures, etc., adapted to be brought in succession by the turning of the platform to a position between the source of light and the screen so that the shadow of the miniature object will be thrown upon the screen.

Pertaining to Vehicles

BODY FOR AUTO-TRUCKS.—W. K. WATERMAN, 12 S. 18th St., Flushing, L. I., N. Y. The inventor provides a knockdown body for auto-trucks, arranged to permit of shipping the wagon body in knockdown condition to a distant place, and to enable a local wheelwright or other mechanic to quickly and conveniently set up and attach the wagon body to a truck chassis of any construction. It permits of manufacturing the wagon body in units for forming a wagon body of any desired length.

LOCKING MEANS FOR CLUTCH LEVERS.—P. L. STARR, Box 365, Weed, Cal. It is well known to those experienced in the operation of the Ford automobile as at present constructed, that it is necessary to constantly maintain pressure on the clutch lever while the low speed gear



LOCKING MEANS FOR CLUTCH LEVERS

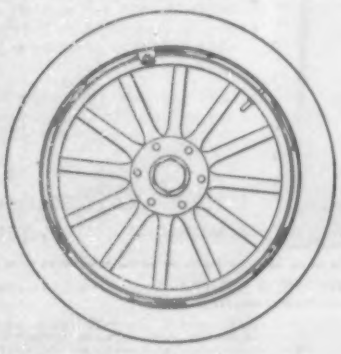
is in use. This invention provides a mechanism for locking the clutch lever in its low speed gear position so that the driver of the machine when traveling over difficult places, may remove his foot from the lever and thus relieve himself of the strain of continuously pressing against the same.

DETACHABLE WHEEL RIM.—C. D. PAXSON, 457 Heppe Bldg., Cleveland, Ohio. This invention has reference to detachable rims for automobile wheels and more particularly of the type in which the detachable rim is formed in sections so that one section may be moved to permit the tire to collapse for facilitating its removal.

HOSE CLAMP.—T. A. BOOR, Ashville, Ohio. The prime object here is to provide a hose-clamp in the form of an elastic band which may be readily attached and detached, and will exert the necessary compression on the hose without engaging the latter, while at the same time the clamp will very effectively resist the jarring and vibration to which it is subjected when employed on an automobile. Mr. Boor has invented another hose-clamp. The invention provides a hose clamp in the form of convolute elastic band which may be readily attached and detached, and which will exert the necessary compression on the hose without damaging the latter, while at the same time the clamp will very effectively resist the jarring and vibration when used on an automobile.

WIRE WHEEL CONSTRUCTION.—H. L HUBBARD, 1472 E. 114th St., Cleveland, Ohio. This invention provides a wire wheel construction which will enable the use of a demountable rim, so that an automobile or similar vehicle using wire wheels need not carry an extra wheel at all, since an extra rim may be fitted to any of the wheels, the latter being permanently fixed to the wheel.

DEMOUNTABLE RIM.—A. ALLGRUN, 157 E. Blackwell St., Dover, N. J. This invention relates particularly to demountable rims providing for the easy and rapid interchange of other tires carried by such rims. It provides a special rim



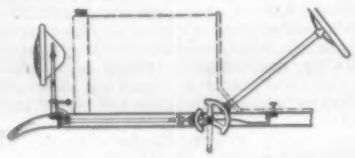
DEMOUNTABLE WHEEL

construction for a wheel, said rim construction including a pair of coöperating and relatively movable rims, one of which is fixed to the felly and the other of which carries the tire and is removably connected to the stationary rim.

AUTOMOBILE STEERING DEVICE.—W. J. LAUGHLIN, 860 8th St., Beloit, Wis. The object of this improvement is to provide a device connectible between the front axle and the steering rod of an automobile which embodies such means whereby the machine will be kept in a straight-away course without the particular attention of the driver of the vehicle.

BICYCLE GEARING.—F. V. WHITMAN, Walkerville, Mont. In this patent the invention is an improvement in bicycle gearing, and the object is the provision of an improved transmission of the character specified, and comprising a high speed, a low speed, and a braking mechanism operated by the treadles.

DIRIGIBLE HEADLIGHT OPERATING MECHANISM.—E. C. SMITH, Box 83 Fallon, Nev. This inventor provides a mechanism for operating the headlights of motor vehicles whereby they may follow the curves and turns in the road in illuminating the same, incorporating means



DIRIGIBLE HEADLIGHT OPERATING MECHANISM

whereby the headlight operating mechanism may be thrown into and out of operation at will. He provides a mechanism coupled with the steering gear and movable into and out of operable relation therewith, in order that if desired the light may be kept stationary while the vehicle is traveling.

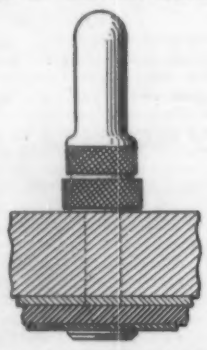
GUN CARRIAGE FOR ORDNANCE.—E. RIMAILHO, 98 Rue de la Victoire, Paris, France. This invention provides a gun carriage adapted to be supported, irrespective of the nature of the ground by three points of contact. These points of contact are independent of the wheels, two of these points being constituted by the ends of the divided trail diverging toward the rear of the gun, and the third by the end of a street placed underneath the axle, the length of the street being such that the wheels are suspended from each end of the axle in the firing position.

ELECTRIC GAS ENGINE STARTING AND BATTERY CHARGING SYSTEM.—H. H. M. KAMMERHOFF, 159 Cleveland St., Orange, N. J. This invention has to deal more particularly with starters of that type on which a dynamo electric machine is adapted to be used as a motor for starting the engine and as a dynamo after the engine is started, whereby can be charged the storage battery that initially supplies current to the dynamo electric machine to operate it as a motor, and whereby current can be utilized for the lamps of the automobile.

AUTOMOBILE STEERING WHEEL.—C. S. HALL, Sandcoulee, Mont. This wheel is formed of a resilient material, such as rubber, whereby the driving of the automobile is rendered easy and comfortable; is warmer in winter than wood or metal; will collapse or yield in case the driver is thrown against it; may be readily molded with any desirable number of spokes or solid between rim and hub if desired; and is readily attached to the steering column of an automobile.

PNEUMATIC TIRE-BUILDING APPARATUS.—P. DE MATTIA and B. DE MATTIA, Garfield, N. J. The present invention relates to improvements in tire-building apparatus, and more particularly to apparatus such as set forth in United States Patent No. 1,194,967 granted to Messrs. De Mattia. Among the principal objects the present invention has in view are: to obtain a greater extension of the centering bars; to prevent the inadvertent retraction of said bars; and to simplify the construction and to reduce the cost thereof.

VALVE FOR PNEUMATIC TIRES.—G. A. MOHR, 319½ South Washington Ave., Lansing, Mich. The present invention relates to Patent No. 1,108,640 and provides a compression joint in the path of air from the outer end of the valve tube and at the same time enables certain of



VALVE FOR PNEUMATIC TIRES

the parts to be more economically constructed. The device has been thoroughly tested and has been run 3,500 miles without pumping up the tires, and has got from four to seven thousand more miles out of the same tires used on the same kind of car.

BRAKE MECHANISM.—E. A. DIETERICH, 910 Caldwell Ave., Bronx, N. Y. The improvement provides a brake mechanism more especially designed for use on automobiles and other vehicles and devices and arranged to insure a quick and graduated application of the vehicle brake in an exceedingly economical manner and without producing undesirable vibrations.

COLLECTION WAGON.—H. BAUMAN and I. TEITELBAUM, 61 E. 4th St., New York, N. Y. The objects here are to provide a cover for the body and means whereby the cover will be automatically raised as the body tilts in the act of dumping its contents, said cover-elevating mean being so designed that the cover will be automatically restored to closed position by the body returning to its normal position.

STEERING DEVICE.—W. B. THOMAS, 336 E. 1st St., Jacksonville, Fla. This inventor provides a device wherein the column and the controlling devices for the motor are adjusted in length, and wherein the wheel may be folded

STEERING DEVICE

into the plane of the column, and wherein the act of folding the wheel into the plane of the column will collapse the column and controlling mechanism, and wherein the moving of the wheel into a plane transverse to the axis of the column will lock the column in adjusted position.

RADIATOR ATTACHMENT.—D. MCR. LIVINGSTON, 22 E. 31st St., New York, N. Y. This invention relates to a mask for the radiator of an automobile, being similar to that of the mask forming the subject of Mr. Livingston's former patent No. 1,156,017, in which the attachment masks the particular character of any given radiator, being constructed to cover the radiator and its casing, the mask permitting freedom in producing stream-line effects regardless of the design of the masked radiator. The present invention improves his radiator referred to, whereby not only to prevent reduction of the radiator's efficiency by the mask, but to cause the mask to increase the efficiency of the radiator.

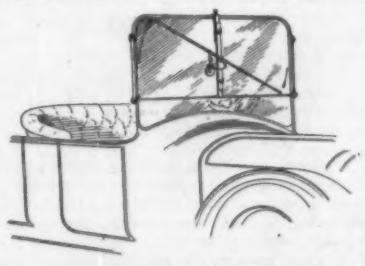
PROJECTING LAMP.—H. W. GEROMANOS, care of Coöperative Engineering School, 316 Huntington Ave., Boston, Mass. This improvement provides an efficient headlight in which an intense beam of light is formed in front of the vehicle in such a way that it covers a predetermined area having a given length and a given width, the quantity of light being variable, depending on the regulations of any particular state.

WHEEL HOLDER.—H. E. JONES, Ebensburg, Pa. This device is for use by wheelwrights. The invention provides a device on which a wheel may be placed and replaced with rapidity, and on which the wheel may be disposed at any desired angle and turned about its axis whereby to promote experience in operating on any given part of the wheel.

TIRE.—T. V. ELLIOTT, care of Hotel Churchill, 14th St., and Broadway, New York, N. Y. The object here is to provide a tire arranged to permit convenient removal of the tread when worn out, and replacing the same by a new one, to prevent puncturing of the shoe and inner tube and to relieve the shoe of all undue strains.

AUTOMOBILE LAMP.—F. E. WOLCOTT 69 Imlay St., Hartford, Conn. An object here is to provide a lamp comprising a casing adapted to be held in stationary position by any suitable brackets or supports and having a window or lens at its front, and also being provided within the casing with a movable reflector adapted to throw the light normally downwardly at some convenient distance closely in front of the vehicle.

WIND-SHIELD CLEANER.—O. E. WALL, Box 648 Honolulu, Hawaii. The chief features of the apparatus are an oscillating lever, a wiper attached to its extremities and thus adapted to reciprocate and sweep over the surface to be



WIND-SHIELD CLEANER

cleaned, an electric motor for operating said lever, and an extensible clamp adapted for attachment to the frame of a wind-shield and on which the other parts of the apparatus are operatively supported.

AUTOMOBILE DOOR.—S. A. PICKENS, 1777 Broadway, New York, N. Y. This invention provides means for deflecting the air through which an automobile may be passing through the body of the door thereof for creating a circulation of relatively cool air adjacent to the floor of the automobile; provides means for preventing the rattling of the air-circulating members when in closed position; and provides means for automatically increasing the intake of air proportionate to the increase of speed of the automobile and coincident with increase in heat below the flow of the automobile.

STEERING GEAR.—J. R. S. SMITH, Box 11, Placerville, Colo. The invention relates to motor vehicles or other analogous machines and particularly to steering gears for such machines. It provides a mechanism whereby the driver may have direct and effective control of either the front wheels or the rear wheels independently of each other or whereby he may operate all of the wheels at the same time.

FOLDING BACK.—H. W. WEED, 21 4th St., Stamford, Conn. The invention provides a folding back for motor cycles, bicycles and like machines and devices, arranged to permit the rider to readily swing the folding back into an approximately horizontal position for mounting and dismounting purposes, and to swing the folding back into upright position for supporting the back of the rider.

TRANSMISSION MECHANISM.—T. LAFITTE, 6 Rue Gager-Gabillot, Paris, France. This invention provides a mechanism having several speeds and reversing motions, applicable in particular to automobile vehicles. Such device is essentially constituted by a motor of the rotary kind, the cylinders and crank shaft of which, in the case of an explosion engine, for instance, can be rendered stationary or movable, by means of two brakes or the like, the pulleys of which are fixed on the same. It is possible in such device to use any engine of which the elements, cylinders and the like, crank shaft or the like, are differently rendered stationary

Designs

DESIGN FOR A FLOWER HOLDER.—A. J. NASH, Tiffany Furnaces, Corona, L. I., N. Y. In this design the plan view shows a circular form of holder beautifully ornamented in graceful patterns, while the side elevation represents the holder with a wide body resting on a sloping and spreading base and topped by an attractive crown piece.

DESIGN FOR AN ARTICLE OF MANUFACTURE.—L. M. MUSLINER, care of Geisman, Musliner & Brightman, 27 Spruce St., New York, N. Y. This design comprises a mass of embroidered work on a white field. The design is to be applied not only to a sheet of leather but to any other sheet or flat surface, as for instance cloth, paper, sheet metal, wood and other materials capable of receiving the impression.

DESIGN FOR AN AUTOMOBILE BODY.—C. DUMELIN, 223 E. 48th St., New York, N. Y. In this design for an automobile body the design of both the side and front end presentations shows a construction built on plain but elegant lines and ornamented with very simple but chaste features of embellishment.

DESIGN FOR A GOBLET.—W. E. HUNTER, Care of Economy Tumbler Co., Morgantown, W. Va. The side elevation of this goblet shows an article of very simple and graceful form.

DESIGN FOR A GOBLET.—W. E. HUNTER, care of Economy Tumbler Co., Morgantown, W. Va. The surface ornamentation in this case may be stamped, printed, imprinted, embossed, or worked on or in, or cut upon or in, or executed by any other method on a goblet or other similar article.

DESIGN FOR A GOBLET OR SIMILAR ARTICLE.—W. E. HUNTER, care of Economy Tumbler Co., Morgantown, W. Va. This is a design which may be etched, stamped, printed, imprinted, embossed, or worked on or in or cut upon any suitable glass, china, paper, cloth or other material, and which may be produced on or in or attached to any desired article of manufacture.

DESIGN FOR A CURTAIN.—T. J. MCMAHON, 404 4th Ave., New York, N. Y. In this design for a curtain the front view shows a pair of curtains in Figure 1, and an edge view in Figure 2. The ornamental effect is chaste and secured by a very simple design.

DESIGN FOR A CRETONNE OR OTHER TEXTILE FABRIC.—M. W. RYAN, 395 Broadway, New York, N. Y. The figure is a plan view of a portion of a cretonne or other textile fabric with a very dark field on which is represented a combination of flowers, branches and birds.

DESIGN FOR A RING.—W. SHEFF, 47 Maiden Lane, New York, N. Y. Figure 1 in this ornamental design is a side view of a ring constructed in accordance with the present design. Figure 2 is an edge view of the same.

DESIGN FOR A TALKING MACHINE CABINET.—H. D. DARLINGTON, R. R. No. 12, Dayton, Ohio. This ornamental design for a cabinet comprises an upright structure on four feet. It is cylindrical in form, and the main body of the article is represented ornamentally by a design of organ pipes, while the base portion is hung with a curtain. The top shows a record disk and over this hangs a shade suspended from an arm or support.

DESIGN FOR AN EMBLEM.—A. E. POHLMAN, General Delivery, Wakesha, Wis. The figures in this design consist of a bird with a twig in its bill and perched on a scroll placed between the inner sides of a wreath, the last decorated in the center by a bow of ribbon.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of patentee, title of the invention, and date of this paper.

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L.W. 8-17

McCLURE BUILDING **McCLURE PUBLICATIONS** NEW YORK CITY
McClure's Magazine—The Ladies' World

A Hundred Thousand Men Toiled Twenty Years

to build the great pyramid of Cheops. Marvelous—and extraordinarily wasteful.

Today, in the pine forests of North Carolina, a monster MACK truck is doing the day's work of fifteen teams and twenty men.

A single MACK would have done the work of at least 200 of the slaves of Cheops. Five hundred MACKS would have replaced 100,000 men—and would have enabled the Egyptian king to break all records in pyramid building.

Right now, MACKS are speeding up work in engineering projects that dwarf the pyramid. MACKS hauled the sand and rock dug from the New York Subway tunnels. MACKS delivered granite for Hell Gate bridge. MACKS carried a 20,000 pound casting for the Carnegie Observatory up the steep winding road of Mount Wilson.

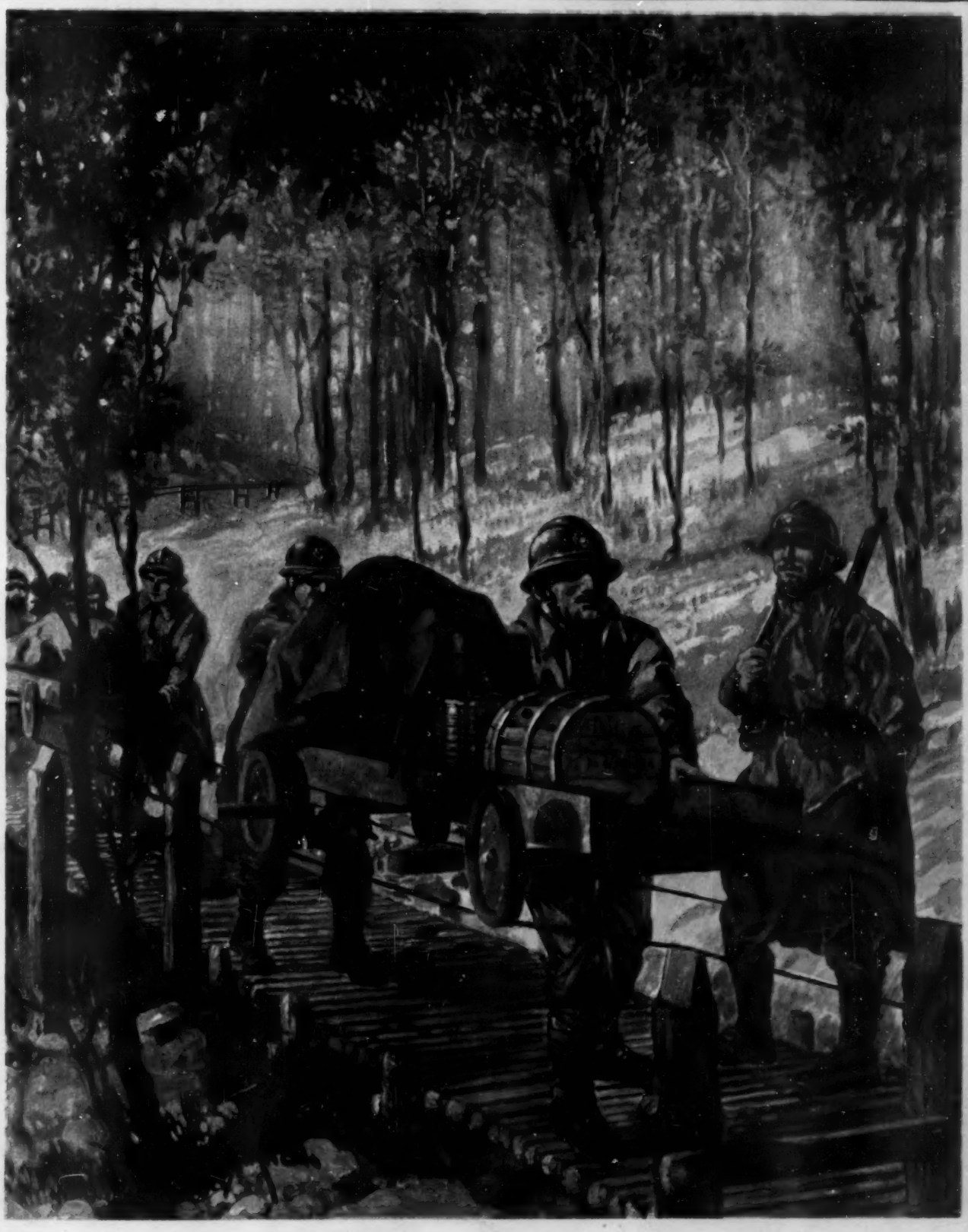
The truck that does these giant jobs is the truck for you.

Write us for facts and figures

INTERNATIONAL MOTOR COMPANY
New York

PERFORMANCE COUNTS

SCIENTIFIC AMERICAN



TRANSPORTING SUPPLIES TO THE FRENCH FRONT BY MEANS OF AN IMPROVISED CABLE RAILWAY—[See page 637]

June 30, 1917

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents

Westinghouse

ALTERNATING CURRENT POWER-PLANT APPARATUS

WESTINGHOUSE ELECTRIC

Modern Westinghouse Turbo-Generators and Switchboard in a Central Station.

Westinghouse Rotary Converter in a Sub-Station.

Westinghouse Individual-Drive Motor.

Westinghouse advertisement in Harper's Weekly of Sept. 3, 1887, showing early type of alternating-current generator.

Pioneering—Past and Present

"Alternating current."

A new term, this, even to the electrical industry, when the advertisement reproduced above appeared thirty years ago.

But George Westinghouse and his associates in the Westinghouse Electric organization knew the day would come when "alternating current" would be familiar even to the layman.

They saw in this method of power-production and transmission great possibilities that have since been realized. And, as the advertisement reprinted above indicates, they had that abundance of courage to back their convictions which the circumstances demanded.

This they did not merely by words but by acts, investing many thousands of dollars to devise and manufacture the apparatus that should make alternating current wholly practical, and thereby laying the foundation for our whole modern system of electrical production and distribution.

That's why today you can drive the machines in your plant or light your home or run your vacuum cleaner by electricity economically though you are miles from the source of power.

This readiness to pioneer, to lead the way toward better means and methods characterizes Westinghouse Electric now as it did thirty years ago. Thus today Westinghouse engineers are ceaselessly striving to improve on the best as the present knows it.

In electrification of railways, application of electricity to the steel mill and development of instruments for preventing interruptions to power-plant service, they have pushed way ahead. They have originated automatic electric cooking, brought specialization of motor application to a new high mark and achieved notable success in other fields of electrical endeavor.

Today Westinghouse products embrace over 300,000 items, from curling irons to turbo-generators and mighty steel-mill motors.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
East Pittsburgh, Pa.